
An empirical examination of consumer switching in NZ retail electricity markets

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Abstract

We examine switching rates in the retail electricity market across 169 NSPs over 37 months. We investigate the impact of price differentials between retailers creating saving incentives for consumers alongside demographic characteristics and government sponsored switching awareness campaigns in several panel data settings. We find strong evidence of inertial and non-rational behaviours in consumer decision making consistent with the limited literature to date. The rate of switching also appears to have a dynamic relationship.

Contents

1. Introduction	3
2. Literature Review	4
3. Data	5
3.1 Switching Data	5
3.2 NSP Data	6
3.3 Market Share Data	6
3.3 Prices and Savings Data.....	7
3.4 Demographic Data.....	8
3.5 Demand Data	8
3.6 Time Indicators	8
4. Econometric Model	9
4.1 Base Model	9
4.1 Pooled OLS vs. Fixed Effects	10
4.2 Fixed Effects vs. Random Effects	10
4.3 Alternative Model Specifications	11
4.4 Autoregressive Models and Dynamic Panel	12
5. Results and Interpretation	13
5.1 POLS and LSDV Results.....	13
5.2 FE and RE Results	14
5.3 Alternative Model Results	14
5.4 Autoregressive Model Results	15
5.5 Dynamic Panel Results	15
6. Conclusion.....	17
7. Limitations	18
8. References	20
9. Appendices	22
9.1 Summary Statistics	22
9.2 Panel Data Structure	22
9.3 POLS and LSDV	23
9.4 FE and RE.....	24
9.5 First Difference.....	25
9.6 Autoregressive Model.....	26
9.7 Dynamic Panel Models.....	27
9.8 NSP Switching Rates by Area-Region	29
9.9 NSP Descriptions and Mappings	41
9.10 Example of Powerswitch Price Data.....	50
9.11 Distribution of Calculated Potential Savings by Region.....	51
9.12 Month on Month Electricity Demand	52
9.13 Consumer Electricity Bill Examples.....	53
9.14 Pricing Data Collection.....	57
9.15 Stata Code.....	62

1. Introduction

In 2009, a Ministerial Review of the New Zealand Electricity Market was undertaken. The review was commissioned to investigate several topical issues including retail electricity prices and competition. The report found residential margins (being the difference between the end consumer price and wholesale market price) were high and that competition between electricity retailers was weak outside the main urban centres. Promoting consumer “switching” between retailers was outlined as one key method to increase pressure on retailer margins so to provide competitive prices and offerings.

Subsequently, through the Electricity Authority (hereafter the EA) and other bodies, there has been increased focus on encouraging consumers to shop around for electricity providers. This has been driven through the implementation of three recommendations from the 2009 Ministerial Review: the creation of an annual \$5 million contestable fund (levy funded) to facilitate switching between retailers – in particular used to finance the What’s My Number (WMN) campaigns; decreasing the timeframe to switch between retailers; and through improvements to the Powerswitch¹ website (operated by Consumer NZ and co-funded with the EA). The EA (2011) note that “[r]etail switching is not valuable in and of itself and can impose transaction costs that lead to higher prices”. As such, the focus has been on increasing willingness to switch when savings are available, rather than increasing the actual switching rates per se. The public awareness campaign WMN led by the EA has been the flagship initiative to promote the benefits of switching. It has focused on providing information about the ability to switch, the ease of switching, and the potential savings that could be attained. Communication have largely been through television commercials though other mediums including bus shelter posters and website advertising have been employed. These aim to motivate consumers to visit the WMN website to get further details and estimate their potential savings through a simple online calculator. Consumer can then proceed to switch retailers online using a link to the Powerswitch website, with the actual switch being activated in 3-4 days on average². Switching is generally free to the consumer, so the only real cost in the switching transaction is search.

¹ <https://www.powerswitch.org.nz/powerswitch>

² <http://www.whatsmynumber.org.nz/faq/switchingprocess>

The \$5 million contestable fund that financed the initial campaign ran for the period November 2011 – April 2014 and the NZ Government has since approved the funding to continue the Campaign for a further three years (EA, 2014). The EA (2013) have estimated that the average annual savings per household for the last three years (2011 – 2013) have been in the magnitude of \$155 – \$175 leading to total national savings in the region of \$260 – \$300 million per year.

With this motivation, we investigate the rates of switching across New Zealand in a panel setting to examine the effects of pricing differentials across retailers (and thus the availability of tangible savings) and the efforts of the EA to promote willingness to switch alongside demographic effects.

2. Literature Review

Empirical work on consumer switching has been relatively sparse, due to the fact that it requires a competitive market place for electricity retailing (or distribution). For the many countries who operate a regulated market, usually with a government owned vertically integrated monopoly, consumer switching is not even a possibility. However, following market reform around the world, largely with the unbundling of previously integrated state owned enterprises, competition has emerged in both the wholesale and retail electricity markets. The main objectives of such reforms being the introduction of competition to induce efficiency gains and to encourage investment and innovation (Shen & Yang, 2012).

Hortaçsu et al. (2014, hereafter HMP) investigate the consumer benefits following deregulation in the Texas residential electricity market. Texas presents an interesting case to investigate retailer choice as consumers were all assigned to the incumbent following deregulation, and then had the option each month to switch away to a new retailer. Government sponsorship of an information campaign was provided to educate consumers on the process and benefits of switching. HMP observe individual household decisions to switch and model this through a two-stage consumer decision making process, the first stage to decide whether to consider switching and the second stage to actually choose a provider (in which the incumbent could still be the outcome). They estimate a logistic model of the consumer decisions using GMM and find two key behavioural results, or sources of switching inertia.

The first is that consumers have a strong inattention bias – that in majority of the cases consumers do not even search for an alternative provider until many months into the new market operations and only 19%

searched in the first year following deregulation. This is despite some of the new entrants to the market pricing consistently below that of the incumbent. The second effect is that of incumbent advantage, or status quo bias, in which consumers view retailers as differentiated despite selling essentially a homogeneous product. They also find consumers react to “bill shock”, in that after receiving a large power bill they are more likely to search for retail options. Demographic effects are also examined and they find evidence that higher education and higher incomes promoting switching behaviour, whilst having more retirees or aged persons in the population reduces switching behaviour.

Daglish (2015) provides a similar analysis of the Mainpower (Canterbury) region of New Zealand. He too observes household level data and models consumer choice to switch through logistic regression. He finds similar inertial behaviours to HMP though does not find evidence of bill shock. Daglish also finds that elderly households are less likely to switch and those with high incomes are more likely. This is the only analysis conducted on the New Zealand market we are aware of to date.

Ek and Söderholm (2008) analyse survey results to understand factors affecting household decisions to switch providers and/ or actively renegotiate with their current supplier in the Swedish electricity market. They focus on the psychological and behavioural factors such as awareness of switching and the availability of gains in switching behaviour. They also find that households that use electricity for heating purposes are more likely to switch.

3. Data

We match a variety of market information to create a novel (though unbalanced) panel for our analysis. Through a challenging process we combine switching data with market information regarding potential price savings and retailer competition, alongside demographic characteristics of the area each NSP is located in. Our timeframe is limited by the availability of retailer pricing data of which we were only able to obtain 37 months from April 2012 to April 2015. Thus while we obtain other data than extends past this period, we exclude it from our analysis. Table 1 (9.1 Summary Statistics) presents summary statistics and Table 2 (9.2 Panel Data Structure) shows the unbalanced nature of the constructed dataset.

3.1 Switching Data

We do not observe individual consumer (or household) switches but rather the rate at which switches occur at a level of local aggregation, that is, about a Network Supply Point (NSP). The Electricity Market

Information (EMI) website³ of the EA publishes monthly data on the number and rate of switches occurring at various levels of aggregation (island, zone, regional council etc.) of which we choose the most disaggregated, being by NSP. A NSP⁴ for our purposes means a point of connection between a local network and the grid, and represents the collection point of households (or ICPs) to the national grid. The dataset contains 200 NSPs across New Zealand of which we observe 169 NSPs in our timeframe. The figures in appendix 9.8 NSP Switching Rates by Area-Region shows the switching rate for each NSP over the sample period.

3.2 NSP Data

Whilst the switching dataset contains the NSP ID, it does not provide any descriptors of the NSP such as network reporting region (and network operator), zone or island. We obtain this information in the NSP table from the EMI wholesale reconciliation dataset⁵. We use the NSP description and the Transpower Asset Map⁶ to find exact locations for each NSP since they often do not have physical street addresses. This is then matched in the Statistics NZ Area Unit Boundary Viewer⁷ to find the Area Unit the NSP falls into. This allows a mapping between census data and the NSP of interest⁸. The census data is further described in section 3.4 Demographic Data. Tables with the mappings from the NSP descriptions to the Area Unit codes can be found in appendix 9.9 NSP Descriptions and Mappings.

3.3 Market Share Data

Similarly to other data available from The EA, we can obtain the market shares of each retailer at each NSP over time⁹. We use this dataset to calculate the number of options (retailers) available to a consumer at a NSP in a given period. We also calculate three dummy variables to measure market dominance, equal to one if the market share of the largest retailer at an NSP in a given month is greater than 50%, 60% and 70% respectively and zero otherwise.

³http://www.emi.ea.govt.nz/Reports/DataReport?param_RegionType=NSP_ROOT¶m_MarketSegment=All¶m_ShowAs=Count¶m_DateFrom=1/1/2004¶m_DateTo=31/5/2015&reportDisplayContext=Gallery&categoryName=Retail&reportGroupIndex=4&reportName=R_SwT_C&eventMode=Sync&reportType=DataReport

⁴ NSP is defined in more detail in Part 1 of The Electricity Industry Participation Code 2010.

⁵http://www.emi.ea.govt.nz/Datasets/download?directory=%2FDatasets%2FWholesale%2FReconciliation%2FNetwork_supply_points_table%2F20150622_Network_supply_points_table.csv

⁶<https://www.transpower.co.nz/transpower-assets>

⁷<http://www.stats.govt.nz/StatsMaps/Home/Boundaries/geographic-boundary-viewer.aspx>

⁸ This entire activity was unfortunately an entirely manual exercise and added significant time to the data collection process.

⁹http://www.emi.ea.govt.nz/Datasets/download?directory=%2FDatasets%2FRetail%2FMarket_structure%2F20150616_Market_share_trends_by_root_NSP.csv

3.3 Prices and Savings Data

Pricing information is sourced from the Consumer NZ Powerswitch website¹⁰. This shows the average annual cost per retailer for a medium sized household (consuming 8096 kWh per year) across 56 areas grouped into 9 regions encompassing all of New Zealand. Monthly prices are shown for the last 3 years on the standard pricing plan and include prompt payment and electronic payment discounts¹¹. We take these prices to be a representative proxy for the actual prices and bills facing consumers for two reasons. Firstly, Hortaçsu et al. (2014) comment that the search and evaluation time to compare retailers by their tariff structure is very costly to the consumer. We suggest that they invoke some form of substitution bias, (Kahneman & Frederick, 2004) employing the average bill size as a proxy for the underlying tariff structures, to overcome this difficulty. Work by Ito (2014) on residential electricity usage in California shows evidence that customers respond more to average prices than to marginal prices adding empirical credibility to this claim. Also the presentation of bills across retailers makes the total price (cost) most salient to the consumer as it is displayed on the front page whilst auxiliary information on the charge per unit and consumption is in the back of the bill. Appendix 9.10 Example of Powerswitch Price Data depicts the retail prices for each area in the Wellington / Lower North Island region as an exemplar. Examples of consumer bills from Genesis and Mercury Energy are provided in appendix 9.13 Consumer Electricity Bill Examples.

From this dataset we calculate two variables, an indicator of possible bill shock, and the potential savings available by switching retailers. To measure the possibility of a consumer realising bill shock due to a sharp pricing increase we employ a dummy variable equal to one if a retailer in an area changes their price by more than 5% and zero otherwise¹². For savings we calculate the (simple) average price in each area and then create our savings proxy as the difference between this average price and that of the cheapest retailer for each month as both a percentage of the average price and in nominal dollars. These potential savings are a proxy for the real savings that could be attained by switching as they are measured by the listed retailer prices and thus could differ from the actual prices realised following a bargaining process with the potential retailer.

¹⁰ <https://www.powerswitch.org.nz/powerswitch>

¹¹ Our data taken in April 2015. If this was to be repeated now, the data for April and May 2012 would not be obtained as the website only shows the last 37 months, though a similar panel could be constructed with data from June 2012 to June 2015.

¹² In our case since we measure the average annual bill size which has fixed consumption, this relationship is a linear mapping to price changes.

The calculated savings in percentage form are visualised by region in appendix 9.11 Distribution of Calculated Potential Savings by Region.

3.4 Demographic Data

Our demographic dataset builds on the NSP to Area Unit mappings described earlier. With an Area Unit code we can map an NSP to census variables such as age, income, education and dwelling characteristics. An Area Unit is the second lowest geographical categorisation (Meshblocks being the lowest) by Statistics NZ, and generally coincide with suburbs in urban areas. They generally contain a population of 3,000 to 5,000 though this can vary due to such things as industrial areas, ports or rural areas within the Area Unit boundaries. There are 2020 Area Units in the 2013 classification which we employ. We calculate the portion of the population over 60, the portion of households with incomes greater than \$100,000, the portion of population with a bachelors education or greater, and the portion of households using electricity for heating purposes following the literature. We use both the 2006 and 2013 census datasets since our timeframe begins in April 2012. We map the 2006 census data to the 11 months from April 2012 to February 2013, and the 2013 data to all following months as the 2013 census was conducted in March 2013. Thus we have variation across both NSPs and time for our demographic variables.

3.5 Demand Data

Demand at each NSP is sourced from the EA's EMI database. We specify NSP (node) level data which is available monthly¹³. Demand data is in GWh which we then use this to calculate the average demand per household (ICP) by dividing by the average number of connected ICPs as a proxy for usage differences, such as rural/ urban intensity differences due to agricultural machinery.

3.6 Time Indicators

We also employ several dummy variables that vary over time but are invariant across NSPs. These include two seasonal dummy variables, Winter – to account for typical increased electricity usage in the cooler months of the year, and Holiday – to account for the traditional summer holiday periods (December and January) in which many people go away on vacation so are less likely to address household expenditure

¹³http://www.emi.ea.govt.nz/Reports/DataReport?param_RegionType=POC¶m_TimeScale=TP¶m_Source=FP¶m_DateFrom=18/6/2015¶m_DateTo=18/6/2015&reportDisplayContext=Gallery&categoryName=Wholesale&reportGroupIndex=6&reportName=W_GD_C&eventMode=Sync&reportType=DataReport

decisions. Appendix 9.12 Month on Month Electricity Demand shows aggregated monthly electricity demand across New Zealand and depicts the annual winter demand peak.

We also employ dummy variables for known periods of intensive advertising relating to the Whats My Number (WMN) campaign. This is sourced from the annual WMN reports from the EA, which state the months television commercials were aired. We encode the 2012 and 2013 campaigns as dummy variables but cannot for the 2014 campaign as the periods have not yet been disclosed¹⁴.

4. Econometric Model

4.1 Base Model

We run panel data regressions over a reduced form model of the switching process. We hypothesize that the rate of switching for an NSP-month is influenced by the level of potential price savings available, the impact of a large price increase leading to bill shock, the demographic characteristics of the local area, the presence of a dominant firm, average electricity usage, seasonal factors and the WMN campaign. The standard model takes the form

$$switchrate_{it} = \alpha_{it} + \phi savings_{it} + \psi pshock_{it} + X'_{1it}\beta + X'_{2it}\theta + X'_{3t}\lambda + \varepsilon_{it}$$

where *savings* is the percentage form of potential savings available; *pshock* is the dummy variable for retailer price changes greater than 5%; X'_{1it} is the transpose of a matrix of control variables of area characteristics (our demographic data) that change over NSP and time; X'_{2it} is the transpose of a matrix of control variables of electricity market characteristics including firm dominance and average demand per ICP that change over NSP and time; X'_{3t} is the transpose of a matrix of time dummy variables that do not vary over NSPs such as the seasonal and WMN campaign dummy variables; β , θ , and λ are coefficient vectors conformable to X'_{1it} , X'_{2it} and X'_{3t} respectively; δ , ϕ and ψ are scalar coefficients and ε_{it} is the error term. The intercept α_{it} has various modelling assumptions dependent on the technique of choice which are outlined below. As the error term is likely correlated over time for a given NSP, so we employ cluster-robust standard errors that cluster on the NSP (Cameron & Trivedi, 2010). We examine the base model under the typical panel estimation techniques and also investigate a dynamic panel setting.

¹⁴ We anticipate this will be available August 2015.

4.1 Pooled OLS vs. Fixed Effects

The first techniques examined are the Pooled Ordinary Least Squares (POLS) estimator and the Least Squares Dummy Variable (LSDV) estimator, one form of fixed effects (FE) estimation. POLS models essentially ignore the panel structure of the data and specify constant coefficients across individuals and time, so is a very restrictive form of a panel regression. In our case this implies that the intercept term $\alpha_{it} = \alpha$ for all NSPs and time periods. POLS is consistent when regressors are uncorrelated with the error term though we are unlikely to satisfy this requirement, as our error term is likely correlated over time for a NSP. This means that standard errors are likely to be misleading and POLS will be inefficient.

We compare the POLS model with the LSDV model in which we include a dummy variable for each individual, or in our case each NSP, so to allow the intercept term to vary across individuals. In such a specification the intercept $\alpha_{it} = \alpha_i$ as we do not allow it to vary across time, but do across NSPs. We then essentially run OLS over this model which includes individual dummy variables for each NSP to produce the α_i that vary across individuals. This approach can be computationally heavy and in our case this requires the estimation of 168 additional parameters (being one less than the number of individual NSPs in our sample to avoid the dummy variable trap since we include the standard intercept as the base case).

The test of choice for comparison between the models is the F Test of Restrictions, in which comparison is made between the two models explanatory power, adjusting for differences in degrees of freedom. The null hypothesis is that the intercepts are the same (so there is an implied modelling restriction), and the alternative is that they can vary (so are unrestricted). We compute this statistic both manually and using built in procedures, with acceptance of the null if the F-statistic is smaller than the critical value. The test statistic is given by:

$$F_{n-1, nT-n-K} = \frac{(R_{LSDV}^2 - R_{POLS}^2)/(n-1)}{(1 - R_{LSDV}^2)/(nT - n - K)}$$

Model and test results are described in section 5.1 POLS and LSDV Results and are presented in appendix 9.3 POLS and LSDV.

4.2 Fixed Effects vs. Random Effects

We next compare the within group (WG) form of the FE model against a random effects (RE) specification.

Within groups provides the same estimates for the slope coefficients as LSDV though does not require the

estimation of the individual intercepts α_i as these are removed from the model by pre-multiplying the model in matrix form by the matrix $M_D = I_{NT} - P_D$, where P_D is a projection matrix of the NSP dummy variable matrix D so that $P_D = D(D'D)^{-1}D'$. This has the effect of time-demeaning the data, hence the name within group estimator, as it exploits time variation within each cross section. It is worth noting that any time invariant variables in the model, such as the individual effects α_i , will be removed by this transformation. OLS is then applied over the transformed model to consistently estimate the slope coefficients.

In a RE set up, the intercept of the base model $\alpha_{it} = \alpha_i$ but this is considered as part of the error term if we specify $\alpha_i = \alpha + \tau_i$ so that the individual effect is due to some individual disturbance τ_i which is fixed over time (if τ_i has zero mean). Here the covariance matrix of the error is such that OLS is not efficient so GLS is usually applied (and FGLS if the components of the covariance matrix are unknown) to regain efficiency. The major assumption underlying this estimation is that the regressors and the error term are uncorrelated. The RE estimator is consistent if the RE model is appropriate and inconsistent if FE is appropriate. We run our base model with RE and FE and then utilise the Hausman Test to identify which model is appropriate. Under the null hypothesis of the Hausman Test the individual effects are random and so the estimators from the RE and FE models should be similar as both models are consistent. However, under the alternative the estimates will diverge which implies that RE estimates will be inconsistent. We utilise the built in command for the Hausman test which needs the additional assumption that RE is fully efficient. We also relax this and allow for RE not to be fully efficient but this requires the use of bootstrapping to estimate the variance matrix needed by the Hausman test. For this we employ the user written command `xtoverid`, but note that we also replicated the same result with a `foreach` loop over the variables in our regression. Model and test results are described in section 5.2 FE and RE Results and presented in appendix 9.4 FE and RE.

4.3 Alternative Model Specifications

We also consider a first difference (FD) model as another method of fixed effects estimation. Like the within groups estimator this model removes any time invariant variables including our individual NSP fixed effects, but do so by first differencing the variables against their one period lagged values. Since the intercept terms α_i do not change over time this differencing simply eliminates them from the model. This technique still yields consistent estimators of the slope coefficients though can be less efficient than the within groups

estimator if the error term is iid (Cameron & Trivedi, 2005). Estimation results are described in section 5.3 Alternative Model Results and presented in section 9.5 First Difference.

4.4 Autoregressive Models and Dynamic Panel

Finally, we investigate the dynamic nature of the panel through first an autoregressive process and then through a dynamic panel setting. Autoregressive (AR) models are very common in time series applications but less so in microeconometrics since we usually have a short panel structure. Since we observe 37 months of data we are in a position to investigate AR tendencies in the switching rate though we have to be cautious not to eliminate too many observations, as each lag component will remove one month worth of data across all NSPs. We hypothesise that the first lag of switching may capture peer effects in which households who successfully switched in one period and had an easy experience may be likely to share their experience with their neighbours and friends, creating additional switching momentum. Later lags may capture the review process of households, as they seek to review their options usually on some periodic basis e.g. once a year – in which the 12 month lag will be an important indicator.

Dynamic panel techniques are becoming increasingly prominent as they allow researchers to capture dynamic relationships (or partial adjustments) between variables that cross sections alone to do not provide, whilst allowing for heterogeneity in adjustment processes across individuals that aggregated time series may not capture correctly (Bond, 2002). Essentially the model is the same as in the standard panel setting with the addition of lagged values of the dependent variable to account for the dynamic adjustment process.

One issue that has been of note in dynamic panel estimation is the so called Nickell bias, in which the demeaning process of the WG estimator creates a correlation between the regressors and the error term in a short panel setting (or “small T large N”). This creates a bias in the estimation of the coefficient of the lagged dependent variable which is not offset by increasing the number of individuals in the sample (Baum, 2013). Approaches to solve this have focused on differencing and then instrumenting for the endogenous lagged dependent variable (such as the Anderson-Hsiao estimator). We employ the Arellano-Bond estimator which takes into account more orthogonality conditions than the Anderson-Hsiao estimator, when estimating the full dynamic panel model. Results are presented in Tables 7 and 8 of appendix 9.7 Dynamic Panel Models.

5. Results and Interpretation

5.1 POLS and LSDV Results

Table 3 shows the results of the POLS and LSDV regressions. The relaxation of the restriction of a constant intercept term across all NSPs in the LSDV model leads it to have a much greater model fit than POLS within the sample, attaining an adjusted R^2 of around 69% compared 27% for POLS. We note that the F-statistic for the test on the intercept restrictions is significant at the 1% level, suggesting that the LSDV model is more appropriate. Most interesting in terms of coefficients is that the potential savings enters negatively and significantly into both specifications (though only at the 10% level in POLS). The results suggest that, holding the other factors constant, a 1 percentage point increase in the savings available will on average decrease the rate of switching in the region of 0.01 to 0.02 percentage points (or around 1 to 2 basis points). This result is counterintuitive to traditional rational maximising behaviour by consumers, but could lend some support to the hypothesis of inertial behaviour by consumers of Hortaçsu et al. (2014), the behavioural and psychological components surveyed by Ek & Söderholm (2008), and the survey results from research commissioned by the EA which indicate a significant number of consumers are unlikely to switch at any level of financial incentives.

Interestingly we also find that the WMN campaigns enter negatively and significantly in the model. This again is a surprising result. We compute the model again adding the lagged values of the WMN campaigns, though find these are insignificant except for the second lag of the 2012 campaign which is only significant at the 10% level. This indicates that we have no evidence that awareness campaigns remain salient after communications cease. We also find the price shock variable to be insignificant though this also changes sign across specifications. We find no demographic effects other than an education effect, where areas with a higher portion of population with a bachelors education or greater are more likely to switch. This result is consistent across all specifications. The two seasonal effects, Winter and Holiday enter significantly and with the expected signs, indicating that people do not look to switch during traditional summer vacation periods and that switching is more salient in Winter months, traditionally the high usage periods across the country.

5.2 FE and RE Results

Table 4 presents the FE and RE results. We note that overall the significant coefficients appear similar in magnitude and with the same sign across effects treatments. Again the savings rate enters significantly (1% level) and with the negative sign. As stated above this result is somewhat counterintuitive. The price shock variable is again insignificant and does not enter with the expected sign.

The demographic factors are as previously estimated, though RE estimates a slightly weaker effect to higher education than the FE model. The seasonal factors are again all significant at the 1% level with the expected signs. The WMN campaign are estimated to have similar effects, with significant negative effects on the rate of switching.

The Hausman test and bootstrapped equivalent to correct for clustered standard errors both reject the null hypothesis that RE is consistent at the 1% level. Though the coefficients looked, at least at first pass to be similar, this result is not entirely surprising a priori. It is also highly likely that our observed variables are related to the unobserved NSP fixed effects which would violate the exogeneity assumption if we specified a RE formulation. Demographic and market characteristics are likely correlated with consumer behavioural effects which we do not observe, but are different across NSPs. We consider FE to be the appropriate model following these results.

5.3 Alternative Model Results

The FD model in Table 5 estimates slightly different results to that of the WG estimator. In the FD model the differenced savings variable is not significant but still enters with the negative sign of the other models. The education effect is no longer significant when in differenced form, but is still estimated with a large positive value. Instead we find that the portion of dwellings with electric heating becomes significant and with the expected positive sign, indicating that as households about an NSP increase their usage of electric heating relative to other means, they are more likely to switch retailers. This finding was also reported by Ek & Söderholm (2008). The seasonal variables are still highly significant with at least 5% significance and the expected signs. Only the 2013 WMN campaign is significant in the difference form, though it still estimates a negative impact on the switching rate. We note that the model has very low explanatory power in this form, suggesting that the individual intercept term that captures the unobserved fixed effects at a NSP is very important factor in determining the rate of switching for a given NSP-month.

5.4 Autoregressive Model Results

We run five AR specifications which differ on the choice of lags to be estimated, presented in Table 6. In each case we specify that no constant term be estimated to solely capture the effects of the lagged values of the switching rate. In the base case we estimate an AR(1) process, in which the lagged value is highly significant (at the 1%) level. This specification has a R^2 of over 80% meaning it captures a large portion of the future value of the switching rate. The coefficient is nearly one implying that past values are a very good indicator of the present rate of switching. We also note that the coefficient is less than 1 in absolute value so is in some sense dynamically stable.

Adding additional lagged values we can see that the coefficients enter significantly though the second lag drops away once we add 12 lags. Here we observe a more interesting relationship in which we see that the first lag and then lags at 3 month intervals appear highly significant, perhaps indicating some sort of periodic review by consumers as to their retailer choice. This is somewhat consistent with the EA survey results of periodic household review tendencies, especially the 12 month lagged value which is relatively high in its value relative to other lags perhaps indicating the portion of reviewers on an annual basis (circa 33% of survey respondents in 2013 and 2014 surveys). Following these results, we view that lagged values of the dependent variable are important to add to the model and we consider a dynamic panel process to estimate their effects.

5.5 Dynamic Panel Results

Table 7 presents the results of modelling a dynamic panel with an assumed AR(1) process. We begin with the basic AR(1) process and then estimate this alongside our explanatory variables from the base model using POLS. The lagged dependent variable is highly significant in both specifications with similar magnitude, indicating that around half of the previous switching rate will be carried through to the next period. In the dynamic POLS model our savings proxy enters again significantly and negative. We still find the education effect reported earlier but have two new demographic results. The first is that of the aged population, in which areas that have a higher portion of residents aged 60 or older will decrease the rate of switching. This is consistent with both the EA survey results (who describe them as the “old status quo”) and the findings of HMP (2014) and Daglish (2015). The second is that the portion of households using electricity for heating which enters significantly with a negative sign, in contrast to an expected prior of

positive due to the likely volume effect of larger users. The seasonal variable Holiday is highly significant with the expected sign but the dummy variable for winter months, Winter, is no longer significant. Only the 2012 WMN campaign is significant in this setting and has a negative estimated effect. Caution is required when interpreting the results of the POLS model as there is an inherent endogeneity issue in using the lagged dependent variable as an additional regressor. This is one of our motivations for the Arellano-Bond (AB) estimator presented later.

We then estimate the model using the WG estimator. The lagged dependent variable is still highly significant though its coefficient is roughly halved when compared to dynamic POLS. This is an indication of Nickell bias which will need to be accounted for in our dynamic panel model. The two demographic effects that appeared in the dynamic POLS model, that of the aged population and electric heating, are no longer significant. The higher education effect is still present, though the coefficient is significantly smaller in the dynamic model than in the standard FE model (1.82 vs 2.71). The savings variable is still negative and significant and is of a similar magnitude to the standard FE model. Interestingly the coefficient on Winter is no longer significant in the dynamic FE model after being significant at the 1% level in the standard FE model. Similarly the 2013 WMN campaign is no longer significant in the dynamic FE model after appearing significantly earlier.

To deal with the Nickell bias we could employ the Anderson-Hsiao estimator which is essentially a 2SLS approach, however Arellano and Bond (1991) show that this does not exploit all information available in the sample and instead proposed a generalised method of moments (GMM) estimator which will construct more efficient estimates of the dynamic component of the model. We specify two transformations in the AB set up: first differencing (FD) and forward orthogonal deviations (FOD). The first-difference transformation has one weakness in that it magnifies gaps in unbalanced panels. Since we are in this setting we employ FOD as a second transformation to check the robustness of the AB estimates. The FOD transformation subtracts the average of all future observations from the current value can be calculated even in the presence of gaps. This allows us to retain observations when compared to the FD transformation so is the preferred transformation for our unbalanced panel. We observe that the dynamic estimates are very similar in magnitude in the two AB specifications, and that these estimates sit within the biased POLS and FE models suggesting it has been

correctly estimated (Baum, 2013). The AB estimates imply that around 25% of the switching behaviour of the previous period carries through to the current period.

In this setting we observe the now familiar result that our savings proxy enters significantly but negatively. The education effect differs across the two AB specifications greatly in both magnitude and significance. It is not clear where this leaves the education result. The summer holiday variable is highly significant whilst Winter is not. The WMN campaigns also change in significance across the two AB settings, with both significant in the FOD model but neither in the FD model.

Finally, we relax the assumption of one lag of the dependant variable estimating a further two dynamic panel models, one with the 12th lag also included, and the other with the 3rd, 6th, 9th and 12th lags added. This follows from the results of the autoregressive model where we observed periodic review type behaviour. Table 8 shows the results. One note is that we lose a large number of observations employing the 12th lag especially with the FD transformation. In doing so we can no longer estimate our demographic variables as they become time invariant with the 2006 census data being removed due to the transformations. We present the AB estimators with an AR(1) process from Table 7 in the first two columns for comparative purposes.

We note that the estimate on the first lag is relatively similar across specifications and is always significant at the 1% level, though there is the tendency that including additional lagged dependent variables increases the size of coefficient. The 12th lag enters significantly and positively. In the specifications with the most lags the 3rd, 6th and 9th lags are no longer significant, despite showing high significance in the autoregressive model. Our savings variables is significant and of similar magnitude to previous estimates. Interestingly, the price shock variable is significant in the two new models, with a negative sign. This is not expected a priori. We find that the 2013 WMN campaign is not significant at any of the standard levels. The dynamic component appears to have two drivers, a short run momentum continuation and a more medium term (annual) tendency.

6. Conclusion

This is the first study to look at switching in all areas of the New Zealand retail electricity market and to use panel data techniques. We create a novel panel matching several data sources. We find evidence of non-maximising behaviour regarding switching rates, where the switching rates decrease in the amount of savings

attainable somewhat consistent with the previous literature. Overall we do not find evidence for bill shock consistent with Dalgish (2015). Demographic relationships are also examined though only the education effect appears to be consistently significant across specifications. Government sponsored switching awareness campaigns surprisingly enter negatively into the model. This result deserves additional attention. Seasonality appears in the traditional summer holiday period but we do not find conclusive evidence that switching increases in heavy usage periods, typically winter. We find that the rate of switching has a significant autoregressive component and time series techniques can fit the actual switching rates very well. When employed in a dynamic panel setting the first lag enters extremely significantly in all specifications indicating a positive momentum is carried through from the previous month. Results with increased lags are more unclear, though the 12th lag shows strong significance, perhaps indicating some form of annual consumer review.

7. Limitations

There are several limitations of this study that would be suitable for further investigation with additional time (and space). One of the first would be to conduct more analysis into the attrition of NSPs over the sample. Whilst many gaps in the balance appear not to be systematic, there are a few NSPs that do not span the entire timeframe as they appear to be in run-off (where the average ICPs connected is steadily dropping each month until there is no data reported for following months). It is likely that this is the result of changes in reporting or reconciliation work by either the system or lines operator so is exogenous to the study itself, but it would be worthwhile investigating any bias that may exist as a result of this run off occurring.

Other considerations include the use of Area Units for demographic data. Whilst we did not have any other means to be able to map census data to the NSPs, this is heavily reliant on the assumption that the Area Unit is representative of the households connected to the NSP. There may be bias in some characteristics as NSPs tend to be located just out of suburban areas.

We are also reliant on the assumption that households are free to switch providers though this is not always the case. Some household, particularly in low socio-economic classes, are using pre-paid electricity through providers such as Glo-Bug. Similarly, retailers are locking some consumers into long-term contracts (typically 12 or 24 months) with a small break fee (typically the return of any incentive received to switch).

Though these account for only a small portion of overall users it would be beneficial to be able to control for these situations better.

Whilst we have accounted for consumer initiated switching reasonably well, we have not been able to match this from the retailer side. Ideally, we would be able to also create variables that describe periods of specific retailer promotions to switch, such as the current offerings by Genesis – one month free electricity up to \$250, or Mercury - \$150 credit on your account. We also do not observe door to door sales that are typically used by retailers to induce households to switch. Unfortunately we were also not able to encode a dummy variable for the 2014 WMN campaign though this will likely be remediated in August with the publication of the annual review of WMN by the EA.

Other considerations include calculating the weighted average price for each area using market share data instead of the simple average. This may create increased clarity on the potential savings available at each NSP. One final note would be to include more behavioural factors such as survey responses into the study. Data is collected for the EA annually at various levels. Attempts will be made to obtain these datasets for further updates.

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9. Appendices

9.1 Summary Statistics

Table 1

Variable	Observations	Mean	Std. Deviation	Min	Max
Average ICPs	5,737	12978.450	14710.170	2.000	119300.000
Switches	5,737	203.551	251.774	0.000	2034.000
Switch Rate	5,737	1.465	1.135	0.000	40.000
Population 60+	5,737	0.202	0.071	0.025	0.500
Household Income (\$100k+)	5,737	0.213	0.129	0.000	0.813
Bachelors Education	5,737	0.140	0.094	0.026	0.501
Electric Heating	5,737	0.727	0.120	0.386	0.958
Price Shock (> 5%)	5,737	0.088	0.283	0.000	1.000
Average Savings (%)	5,736	6.890	2.773	0.000	18.033
Dominant Firm (50%+)	5,737	0.536	0.499	0.000	1.000
Average ICP Demand	5,569	0.010	0.104	0.000	5.706
Winter	5,737	0.244	0.430	0.000	1.000
Holiday	5,737	0.161	0.368	0.000	1.000
WmN Campaign 2012	5,737	0.219	0.413	0.000	1.000
WmN Campaign 2013	5,737	0.164	0.370	0.000	1.000

9.2 Panel Data Structure

Table 2

Months Observed	Count of NSPs	Percentage of NPS	Cumulative Percentage
37	144	85.21%	85.21%
36	1	0.59%	85.80%
35	2	1.18%	86.98%
33	2	1.18%	88.17%
30	2	1.18%	89.35%
21	2	1.18%	90.53%
18	1	0.59%	91.12%
17	2	1.18%	92.31%
15	1	0.59%	92.90%
13	1	0.59%	93.49%
12	1	0.59%	94.08%
10	1	0.59%	94.67%
9	1	0.59%	95.27%
8	1	0.59%	95.86%
4	1	0.59%	96.45%
3	3	1.78%	98.22%
1	3	1.78%	100.00%
Total	169	100.00%	100.00%

Table 2 illustrates the unbalanced nature of our panel. Whilst we observe the full time period for 85% of NPSs this still leaves 15% with some form of missing data. For 3 NSPs we only observe a single observation. The gaps appear to be random so are not systemic, but further investigation of potential attrition bias could be one improvement to the study.

9.3 POLS and LSDV

Table 3

	POLS	LSDV	POLS	LSDV
Average Savings (%)	-0.01489* (0.00851)	-0.01963*** (0.00491)	-0.01342** (0.00663)	-0.01651*** (0.00395)
Price Shock (> 5%)	0.01882 (0.03508)	-0.00838 (0.03706)	0.01357 (0.03289)	0.00216 (0.02938)
Population 60+	-1.07637** (0.48979)	-0.33032 (0.69776)	-0.96710** (0.37753)	-0.45037 (0.61412)
Household Income (\$100k+)	0.26760 (0.37966)	0.38030 (0.55511)	0.36454 (0.29507)	0.62142 (0.55047)
Bachelors Education	0.81349* (0.44912)	2.70608*** (0.98482)	0.78040** (0.38881)	2.15409** (0.92430)
Electric Heating	-0.91796** (0.35567)	0.12978 (0.47851)	-0.49298* (0.26010)	0.11281 (0.45883)
Dominant firm (50%+)	-0.35776*** (0.05937)	0.01297 (0.05483)	-0.35441*** (0.05284)	0.01925 (0.04994)
Average ICP Demand	5.30283*** (1.48293)	3.92874*** (1.27744)	2.46837*** (0.91402)	3.16615*** (0.76502)
Winter	0.09097*** (0.03320)	0.09905*** (0.03183)	0.08329** (0.03301)	0.07910** (0.03286)
Holiday	-0.18887*** (0.04205)	-0.18441*** (0.03036)	-0.16227*** (0.02640)	-0.15895*** (0.02551)
WmN Campaign 2012	-0.17500*** (0.05778)	-0.10582*** (0.03564)	-0.09690 (0.06275)	-0.10228* (0.05937)
WmN Campaign 2013	-0.02979 (0.03397)	-0.06274** (0.03146)	-0.04883 (0.03204)	-0.07515** (0.03152)
L.WmN Campaign 2012			0.05765 (0.05433)	0.05968 (0.05550)
L2.WmN Campaign 2012			-0.09618* (0.05589)	-0.03793 (0.05408)
L.WmN Campaign 2013			0.02234 (0.04076)	0.01817 (0.04147)
L2.WmN Campaign 2013			0.04570 (0.03765)	0.04780 (0.03819)
Constant	2.47349*** (0.32727)	1.11048*** (0.33975)	2.09731*** (0.23377)	1.11699*** (0.33548)
Observations	5568	5568	5122	5122
R ²	0.275	0.699	0.140	0.402
Adjusted R ²	0.274	0.689	0.138	0.381
Test of Restrictions				
F-statistic		45.14		
p-value		0.000		

Individual NSP intercept coefficients omitted, clustered standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

9.4 FE and RE

Table 4

	FE	RE
Average Savings (%)	-0.01963*** (0.00405)	-0.01895*** (0.00410)
Price Shock (> 5%)	-0.00838 (0.03117)	-0.00597 (0.03159)
Population 60+	-0.33032 (0.56592)	-0.24015 (0.54352)
Household Income (\$100k+)	0.38030 (0.38382)	0.51463 (0.37856)
Bachelors Education	2.70608*** (0.82584)	1.91292** (0.77620)
Electric Heating	0.12978 (0.39380)	-0.22305 (0.38381)
Dominant firm (50%+)	0.01297 (0.04214)	0.00047 (0.04241)
Average ICP Demand	3.92874*** (0.28882)	4.93461*** (0.21627)
Winter	0.09905*** (0.02161)	0.09793*** (0.02191)
Holiday	-0.18441*** (0.02645)	-0.18778*** (0.02676)
WmN Campaign 2012	-0.10582*** (0.03655)	-0.12675*** (0.03658)
WmN Campaign 2013	-0.06274** (0.02661)	-0.05612** (0.02696)
Constant	1.11048*** (0.29861)	1.62383*** (0.33154)
Observations	5568	5568
Overall R^2	0.20085	0.23796
Between R^2	0.54179	0.55728
Within R^2	0.07055	0.06917
σ_u	2.98708	1.99999
σ_e	0.63925	0.63925
ρ	0.95621	0.90731

Clustered standard errors in parentheses. Note: the overall R^2 for the within groups (FE) model is different to the R^2 to that in the LSDV model (in Table 1) as the within groups estimator in Stata does not account for the individual NSP intercepts in the overall R^2 calculation.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

9.5 First Difference

Table 5

	First Diff.
D.Average Savings (%)	-0.00334 (0.00883)
D.Price Shock (> 5%)	-0.04886 (0.02979)
D.Population 60+	-0.12293 (1.69046)
D.Household Income (\$100k+)	0.33992 (1.17808)
D.Bachelors Education	1.18966 (2.26422)
D.Electric Heating	2.22842** (0.93787)
D.Dominant firm (50%+)	0.11388 (0.15916)
D.Average ICP Demand	1.07217* (0.55314)
D.Winter	0.06852** (0.03278)
D.Holiday	-0.13756*** (0.02481)
D.WmN Campaign 2012	-0.07293 (0.06057)
D.WmN Campaign 2013	-0.15293*** (0.05343)
Observations	5305
R^2	0.013
Adjusted R^2	0.011

Clustered standard errors in parentheses. D denotes first difference.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

9.6 Autoregressive Model

Table 6

	AR(1)	AR(2)	AR(4)	AR(6)	AR(12)
L.Switch Rate	0.90673*** (0.01146)	0.63600*** (0.02727)	0.52960*** (0.02368)	0.48458*** (0.02825)	0.41960*** (0.02553)
L2.Switch Rate		0.29694*** (0.02441)	0.12375*** (0.03068)	0.06999** (0.02891)	-0.00836 (0.01675)
L3.Switch Rate			0.11901*** (0.02716)	0.10337*** (0.02385)	0.07171*** (0.02233)
L4.Switch Rate			0.18715*** (0.01122)	0.08740*** (0.01549)	0.02827* (0.01593)
L5.Switch Rate				0.12297*** (0.03379)	0.03939* (0.02013)
L6.Switch Rate				0.10630*** (0.03264)	0.05236*** (0.01474)
L7.Switch Rate					0.03258* (0.01671)
L8.Switch Rate					0.01819 (0.01642)
L9.Switch Rate					0.06591*** (0.01954)
L10.Switch Rate					0.00131 (0.02258)
L11.Switch Rate					0.12581*** (0.02759)
L12.Switch Rate					0.14602*** (0.02451)
Observations	5476	5273	4924	4602	3675
R^2	0.811	0.836	0.861	0.870	0.889
Adjusted R^2	0.811	0.836	0.861	0.869	0.889

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

9.7 Dynamic Panel Models

Table 7

	POLS	POLS	FE	AB FD	AB FOD
L.Switch Rate	0.57757*** (0.05189)	0.52684*** (0.06257)	0.23037*** (0.02670)	0.24430*** (0.03344)	0.24891*** (0.02829)
Average Savings (%)		-0.00890** (0.00355)	-0.01642*** (0.00384)	-0.02320*** (0.00621)	-0.01623*** (0.00368)
Price Shock (> 5%)		-0.02971 (0.03089)	-0.01850 (0.02956)	-0.04301 (0.03371)	-0.02025 (0.02893)
Population 60+		-0.52082*** (0.18727)	-0.61156 (0.55602)	-0.65581 (1.88518)	-0.61665 (0.53535)
Household Income (\$100k+)		0.11460 (0.15868)	0.40952 (0.42177)	-0.13205 (1.28587)	0.39377 (0.40498)
Bachelors Education		0.40678** (0.19709)	1.81873** (0.73554)	0.69427 (2.13701)	1.77175** (0.70376)
Electric Heating		-0.30460** (0.13551)	0.09582 (0.36788)	2.67289** (1.08273)	0.09918 (0.35179)
Dominant firm (50%+)		-0.16087*** (0.03188)	0.04003 (0.04319)	0.14029 (0.12595)	0.04147 (0.04151)
Average ICP Demand		1.14887* (0.61387)	2.94405*** (0.92057)	0.86584 (1.09249)	2.87978*** (0.86961)
Winter		-0.02629 (0.02712)	0.03562 (0.02721)	0.03549 (0.02807)	0.03204 (0.02641)
Holiday		-0.18714*** (0.02417)	-0.17686*** (0.02367)	-0.18017*** (0.02215)	-0.17711*** (0.02305)
WmN Campaign 2012		-0.07696*** (0.02620)	-0.08576*** (0.03191)	-0.05113 (0.03638)	-0.08562*** (0.03087)
WmN Campaign 2013		-0.01822 (0.01977)	-0.04287* (0.02562)	-0.04813 (0.03059)	-0.04271* (0.02474)
Constant	0.61500*** (0.07462)	1.13204*** (0.15663)	0.94619*** (0.26460)		
Observations	5476	5317	5317	5112	5153
R^2	0.328	0.354	0.489		
Adjusted R^2	0.328	0.352	0.472		

Clustered standard errors in parentheses except Arellano-Bond specification which are robust standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8

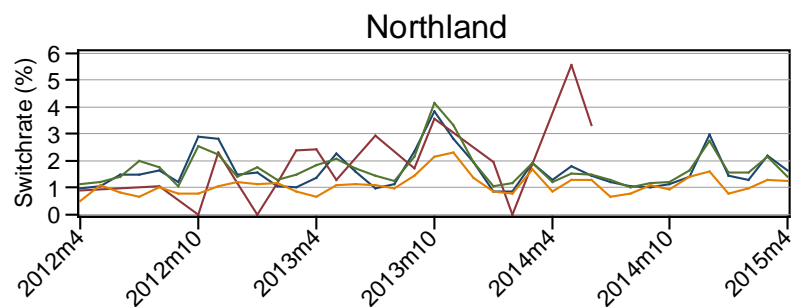
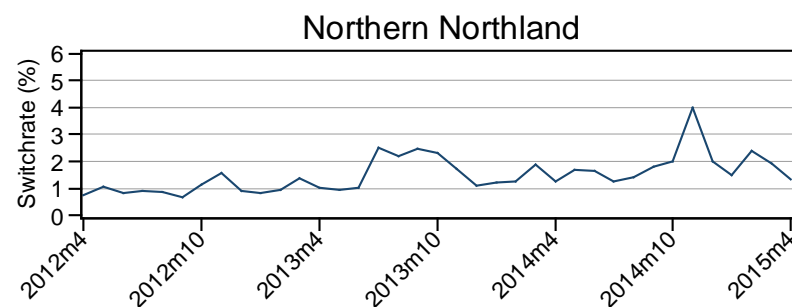
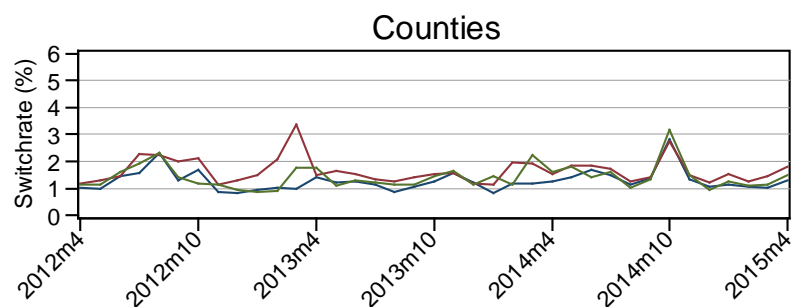
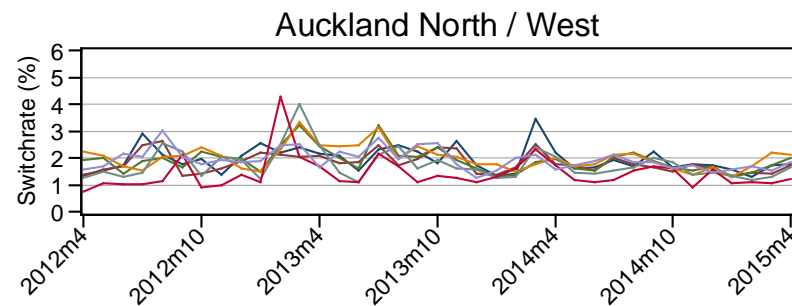
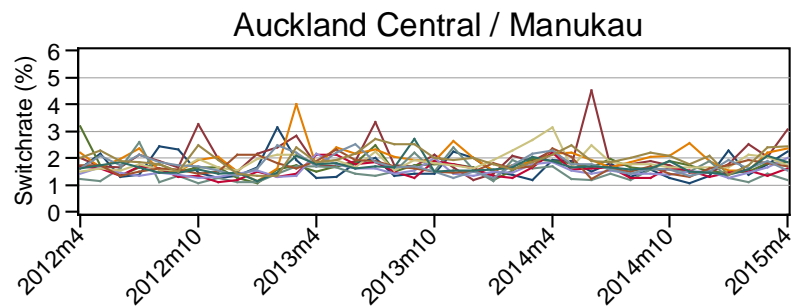
	AB FD	AB FOD	AB FD	AB FOD	AB FD	AB FOD
L.Switch Rate	0.24430*** (0.03344)	0.24891*** (0.02829)	0.19513*** (0.06998)	0.27725*** (0.02713)	0.26761*** (0.02750)	0.29132*** (0.02154)
L3.Switch Rate					-0.03459* (0.02072)	-0.02576 (0.01910)
L6.Switch Rate					-0.00431 (0.01561)	-0.00095 (0.01593)
L9.Switch Rate					0.00567 (0.01677)	0.01431 (0.01990)
L12.Switch Rate			0.13290*** (0.02518)	0.11703*** (0.02516)	0.11793*** (0.02755)	0.11432*** (0.02844)
Average Savings (%)	-0.02320*** (0.00621)	-0.01623*** (0.00368)	-0.02777*** (0.00626)	-0.02220*** (0.00591)	-0.02913*** (0.00547)	-0.02237*** (0.00458)
Price Shock (> 5%)	-0.04301 (0.03371)	-0.02025 (0.02893)	-0.07605** (0.03309)	-0.05954** (0.02815)	-0.08962*** (0.03325)	-0.06383** (0.02886)
Population 60+	-0.65581 (1.88518)	-0.61665 (0.53535)				
Household Income (\$100k+)	-0.13205 (1.28587)	0.39377 (0.40498)				
Bachelors Education	0.69427 (2.13701)	1.77175** (0.70376)				
Electric Heating	2.67289** (1.08273)	0.09918 (0.35179)				
Dominant firm (50%+)	0.14029 (0.12595)	0.04147 (0.04151)	0.30720** (0.12338)	-0.01054 (0.09044)	0.19087* (0.09806)	0.06931 (0.05419)
Average ICP Demand	0.86584 (1.09249)	2.87978*** (0.86961)	1.10857 (0.80012)	2.40807*** (0.50350)	1.51801*** (0.30869)	1.98276*** (0.12362)
Winter	0.03549 (0.02807)	0.03204 (0.02641)	-0.02278 (0.03343)	-0.03373 (0.02752)	-0.01367 (0.02952)	-0.02624 (0.02713)
Holiday	-0.18017*** (0.02215)	-0.17711*** (0.02305)	-0.15134*** (0.02228)	-0.15807*** (0.02080)	-0.15903*** (0.02164)	-0.15339*** (0.02127)
WmN Campaign 2012	-0.05113 (0.03638)	-0.08562*** (0.03087)				
WmN Campaign 2013	-0.04813 (0.03059)	-0.04271* (0.02474)	-0.02110 (0.03465)	-0.00180 (0.02681)	-0.03118 (0.03246)	-0.00406 (0.02757)
Observations	5112	5153	3486	3514	3452	3479

Robust standard errors in parentheses

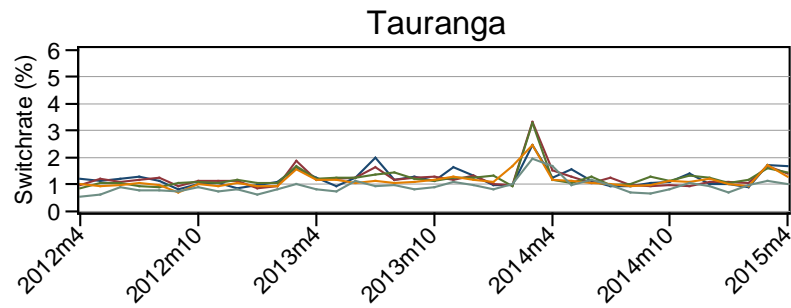
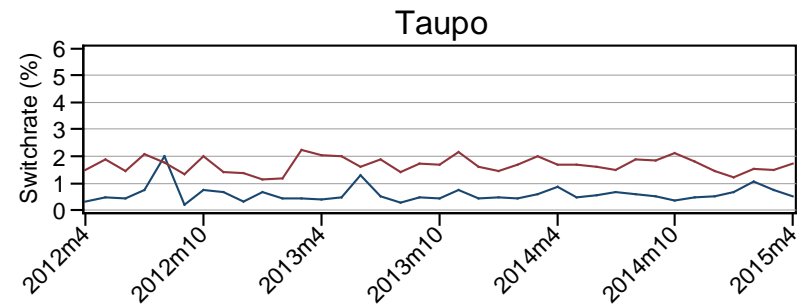
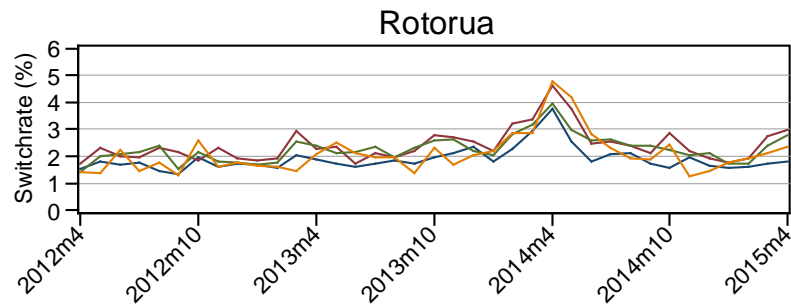
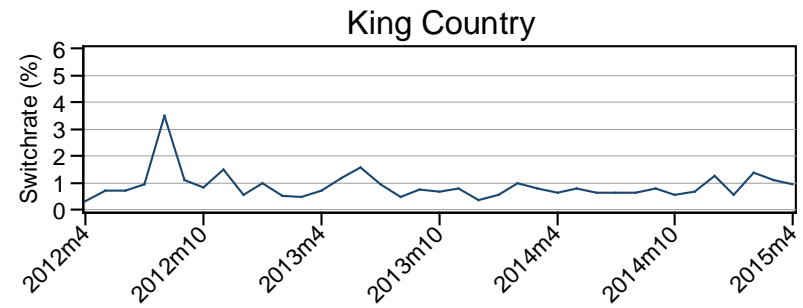
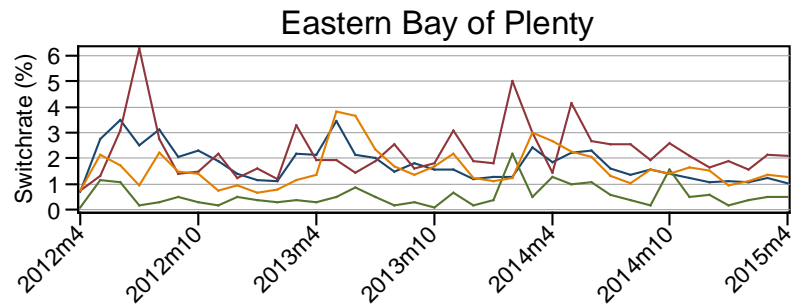
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

9.8 NSP Switching Rates by Area-Region

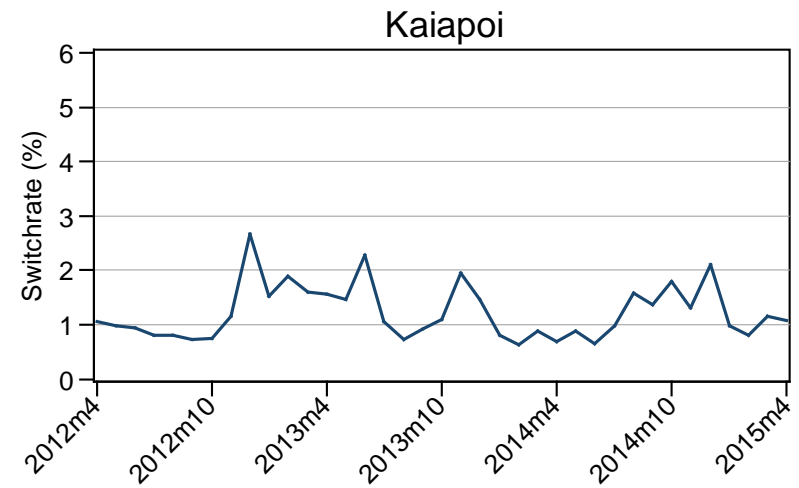
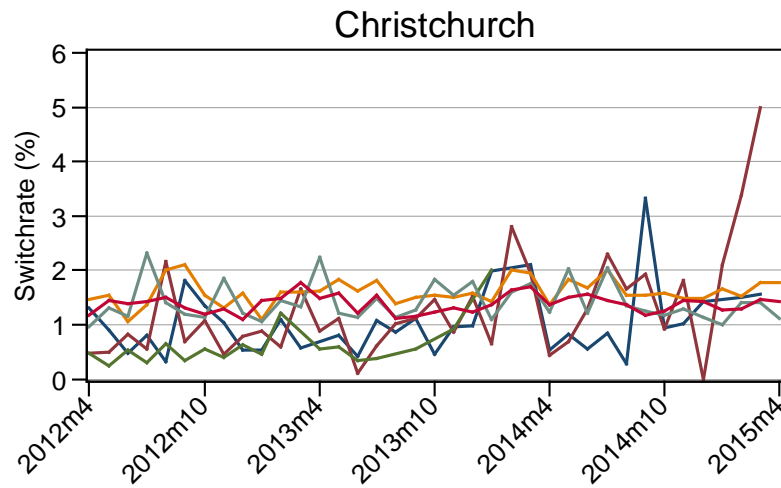
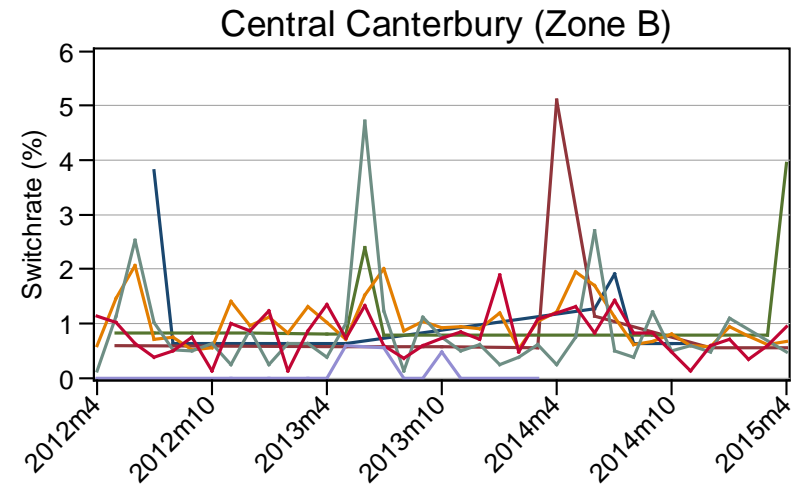
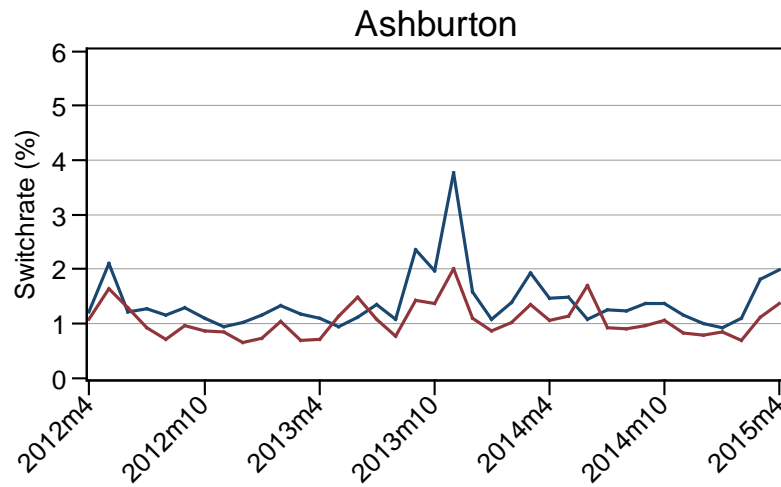
Switch rates by NSP Region: Auckland / Northland



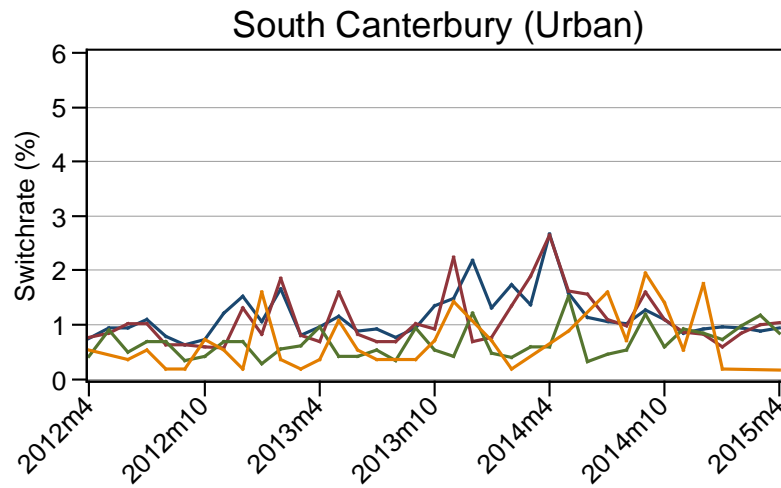
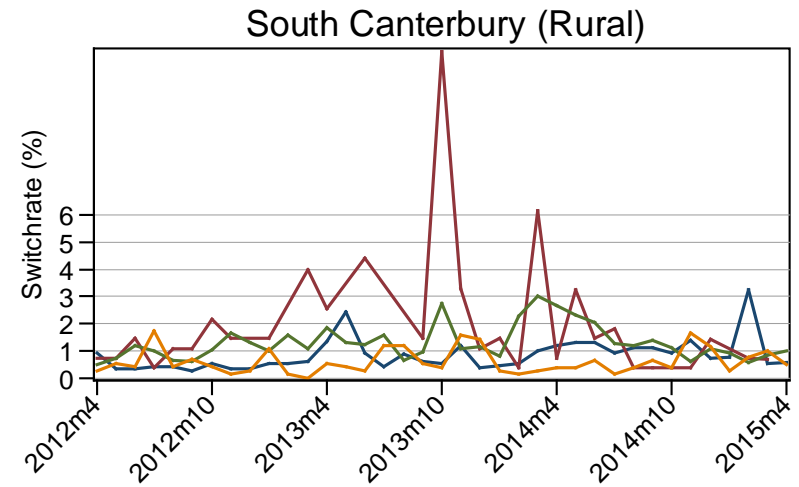
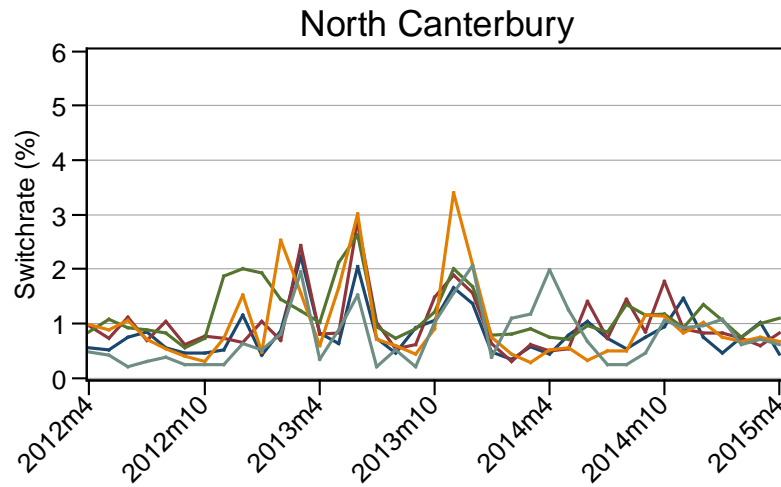
Switch rates by NSP Region: Bay of Plenty / Central North Island



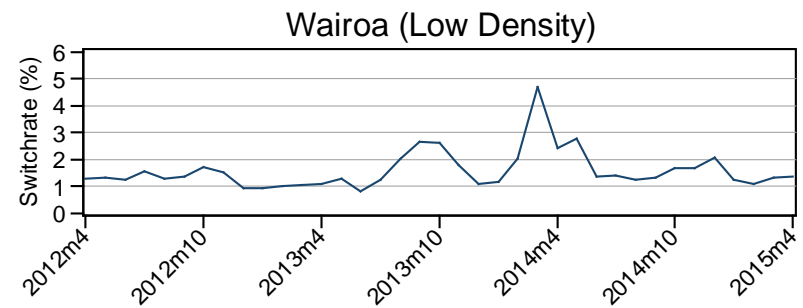
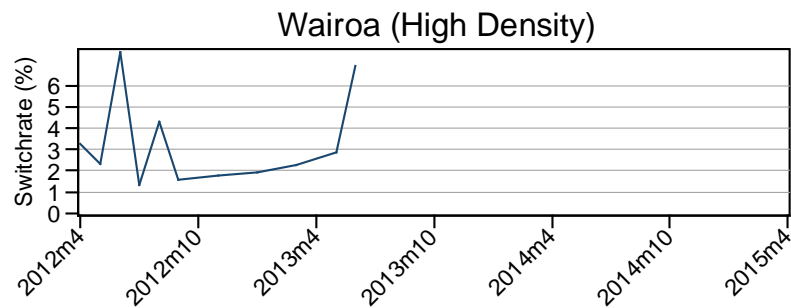
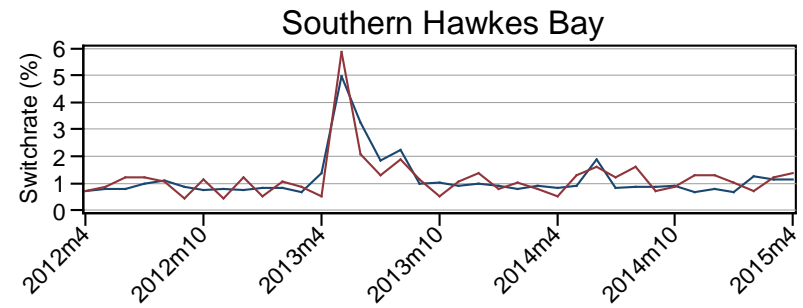
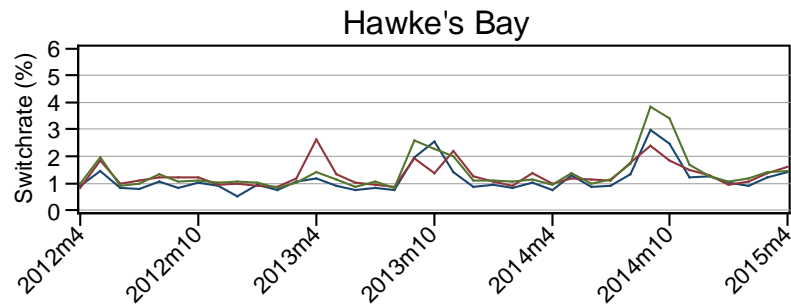
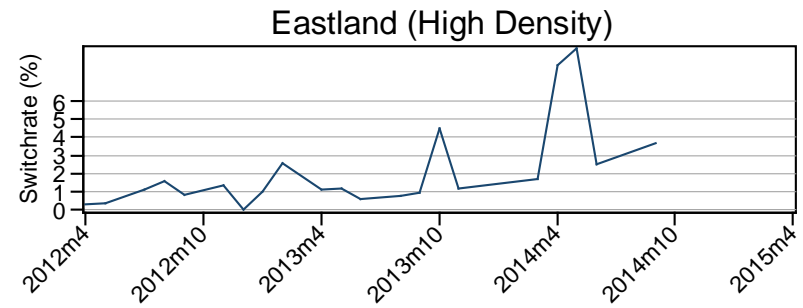
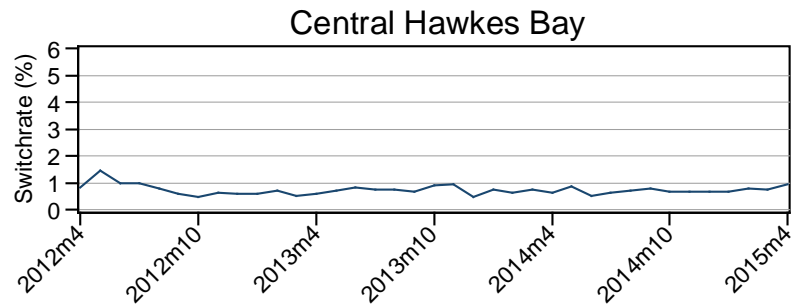
Switch rates by NSP Region: Canterbury (1/2)



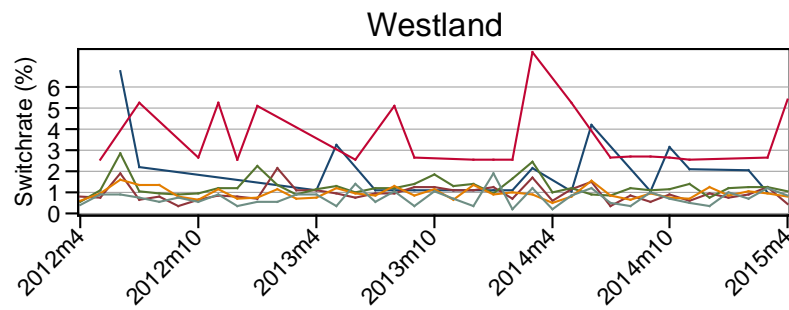
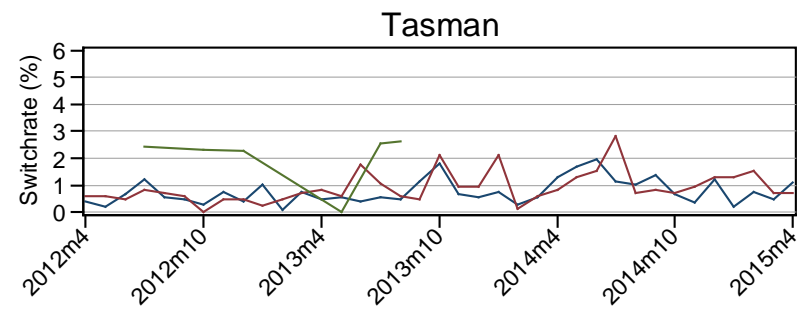
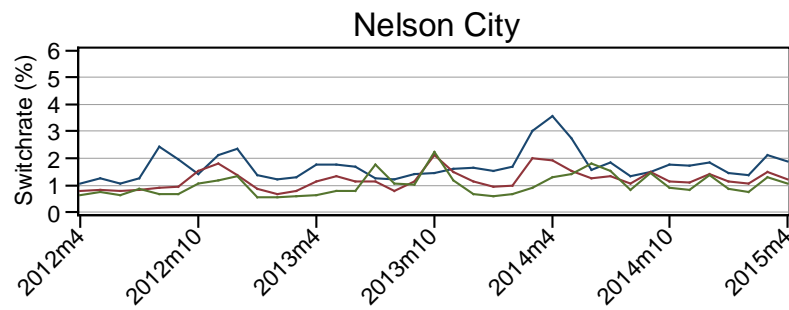
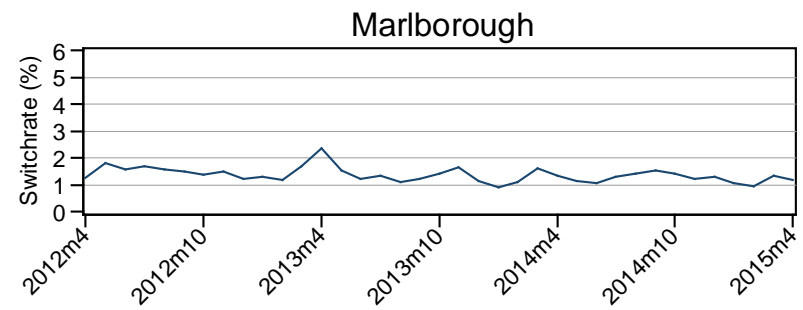
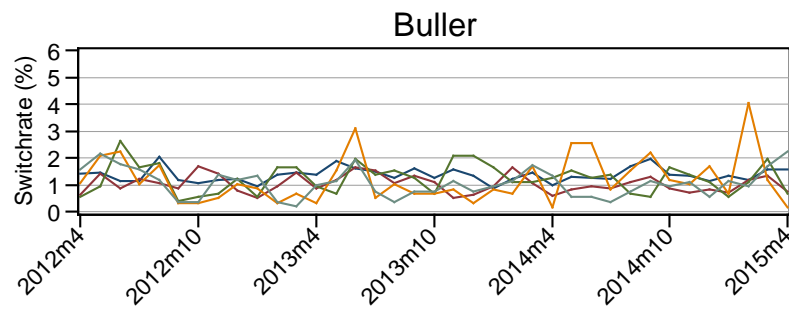
Switch rates by NSP Region: Canterbury (2/2)



Switch rates by NSP Region: Eastland / Hawkes Bay

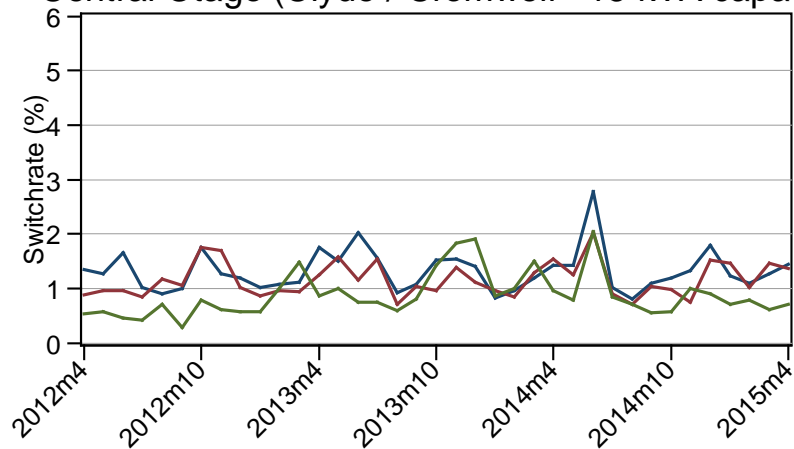


Switch rates by NSP Region: Marlborough / Nelson / Westland

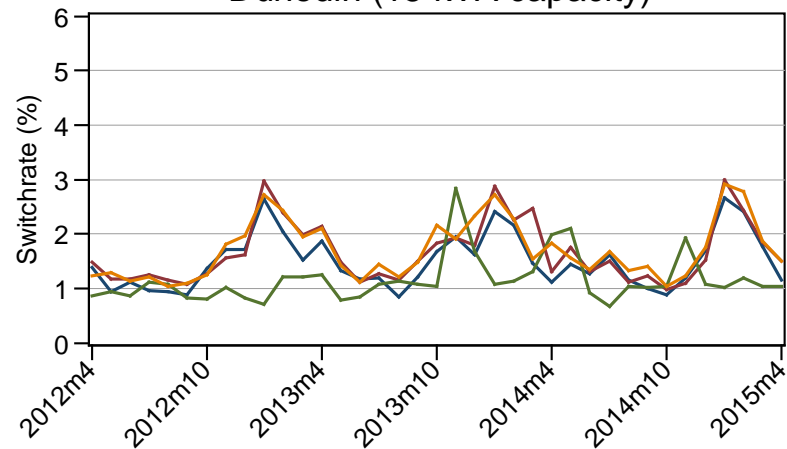


Switch rates by NSP Region: Otago / Southland (1/2)

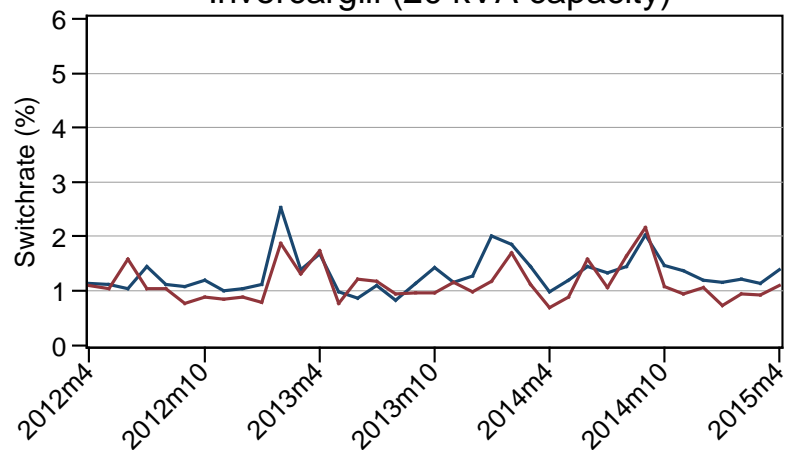
Central Otago (Clyde / Cromwell - 15 kVA capacity)



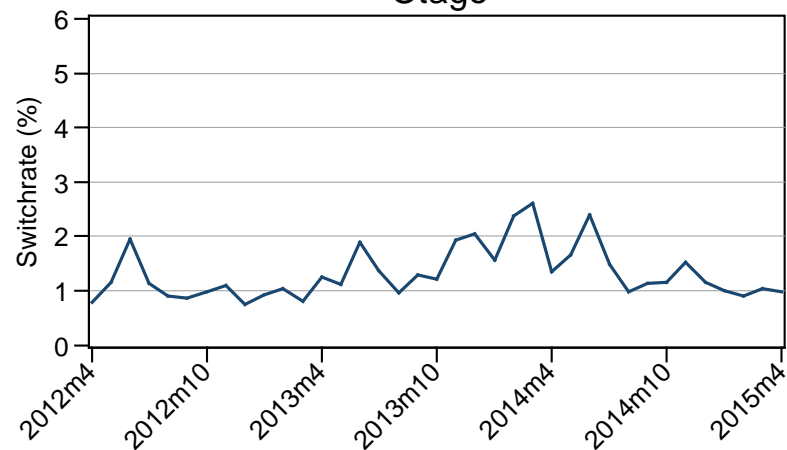
Dunedin (15 kVA capacity)



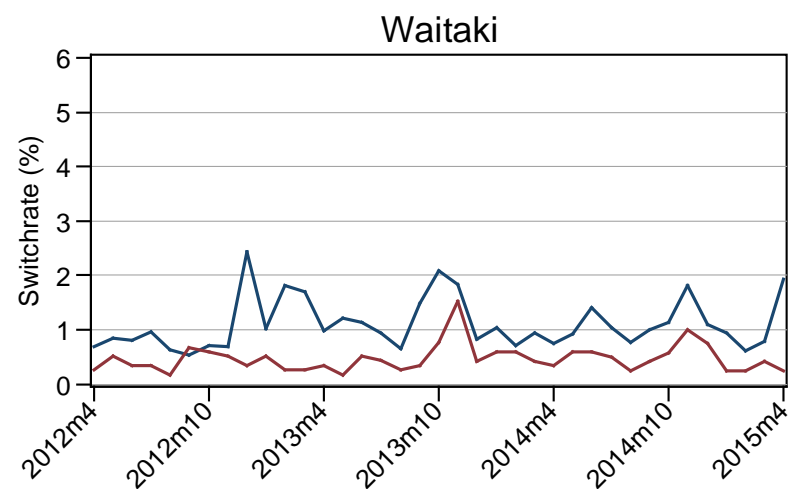
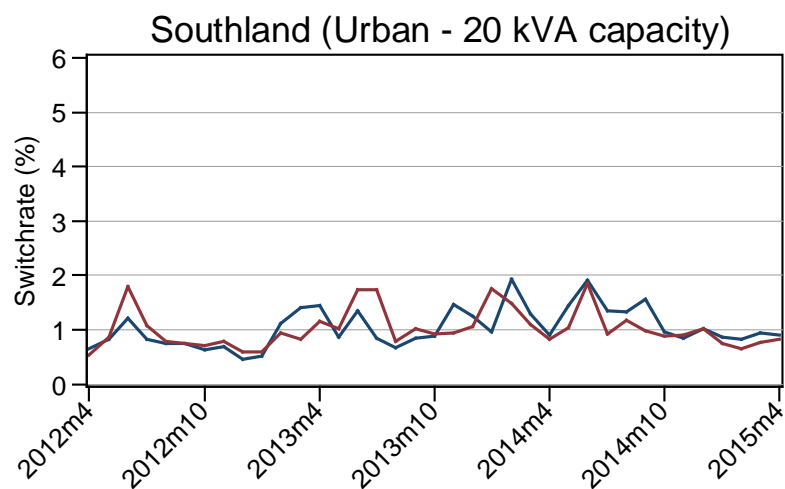
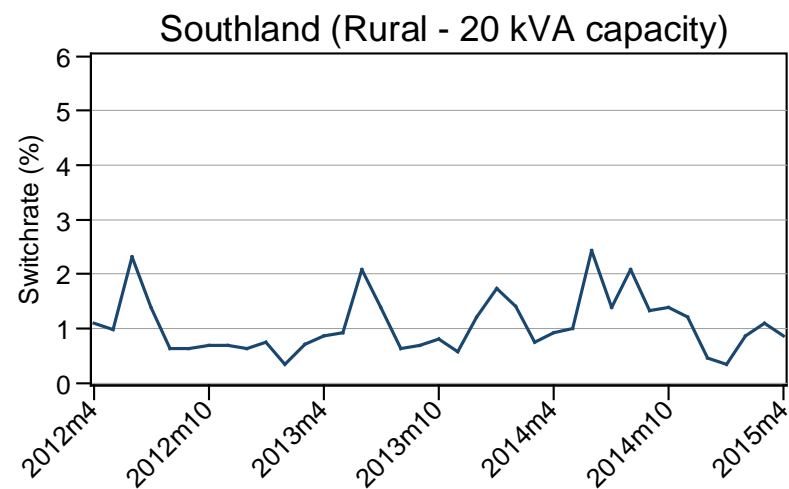
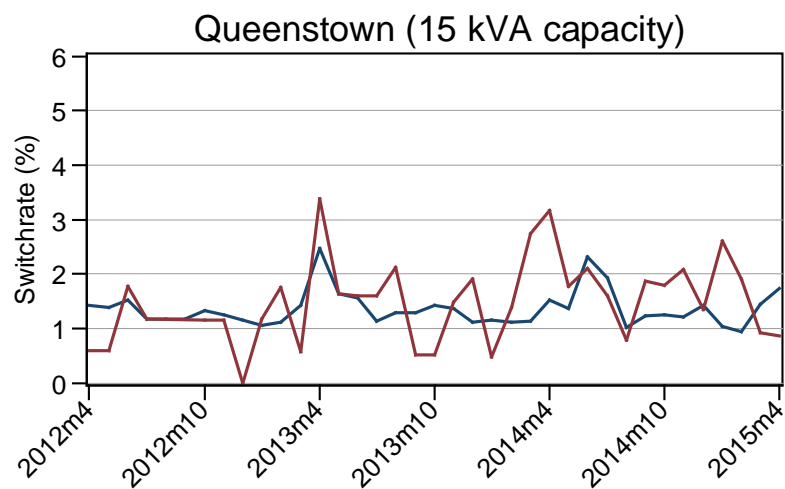
Invercargill (20 kVA capacity)



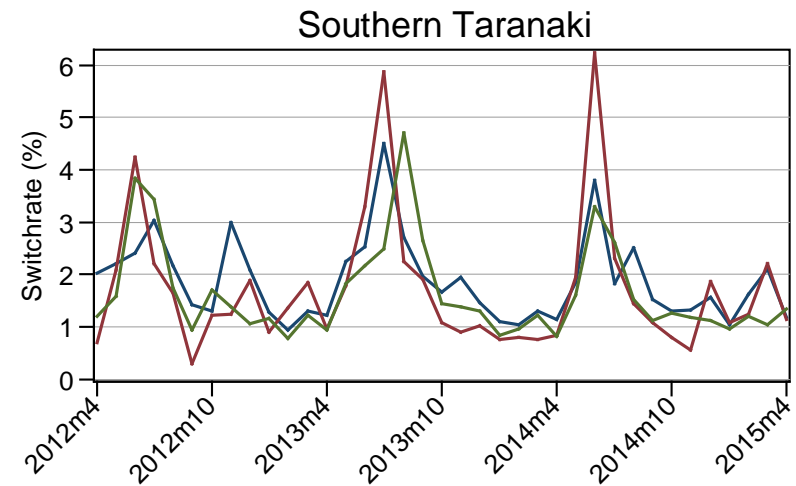
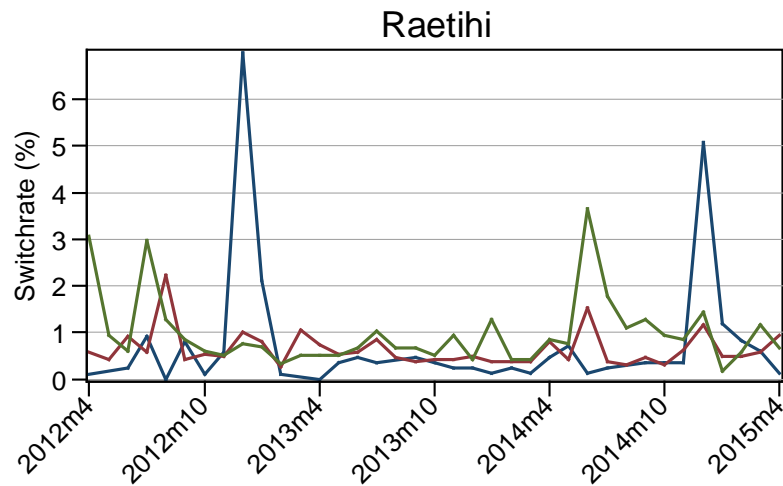
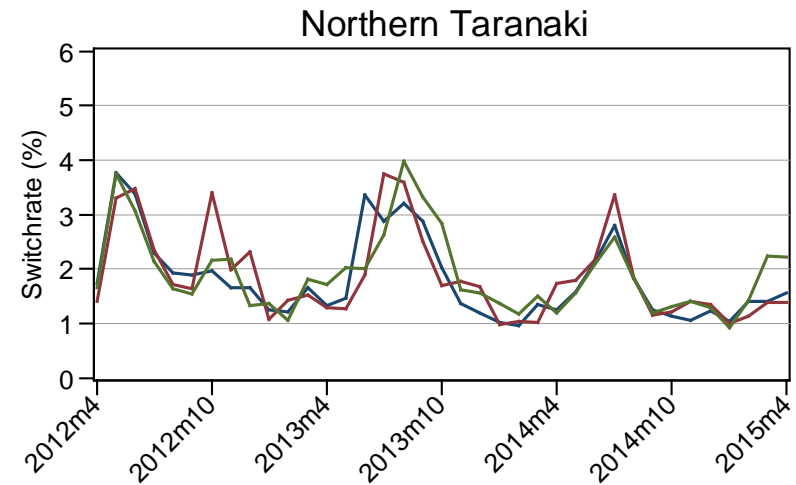
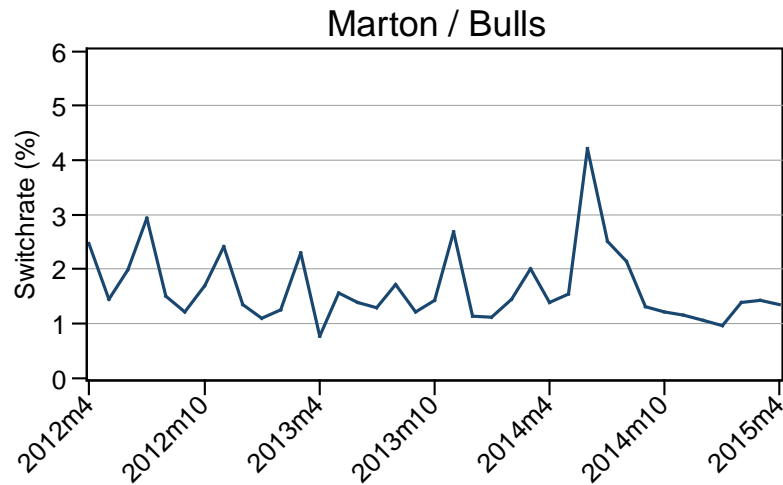
Otago



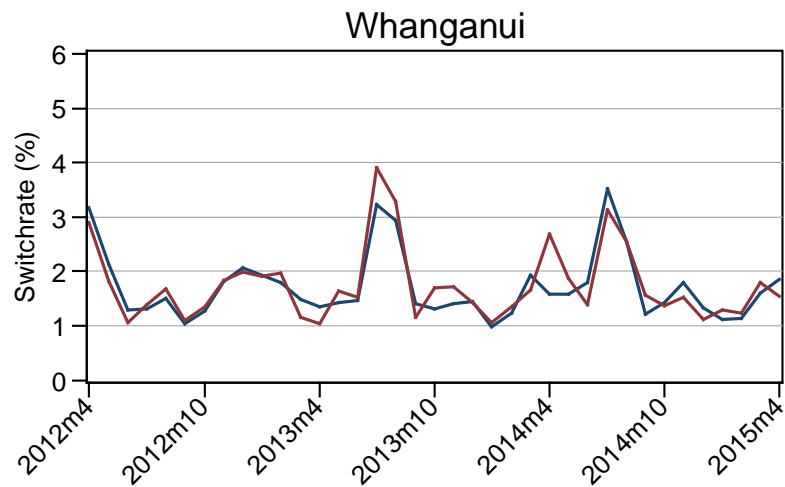
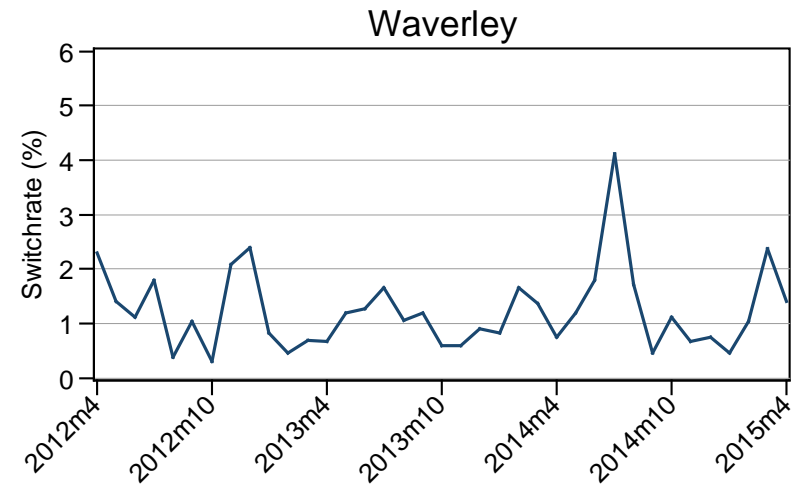
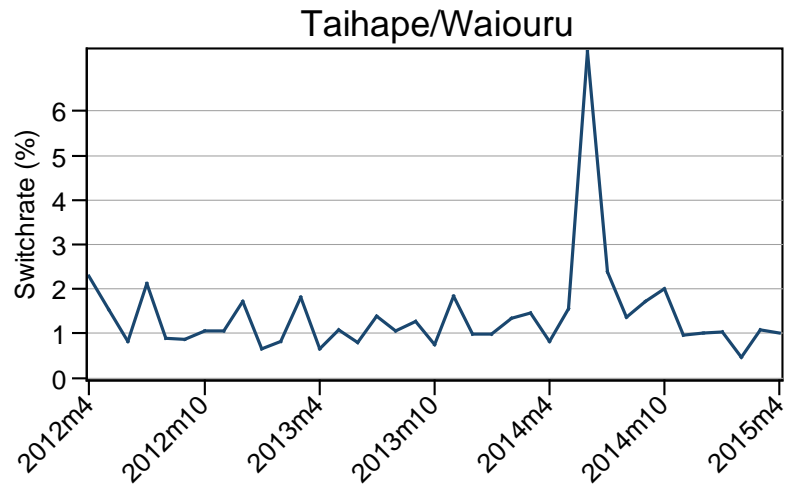
Switch rates by NSP Region: Otago / Southland (2/2)



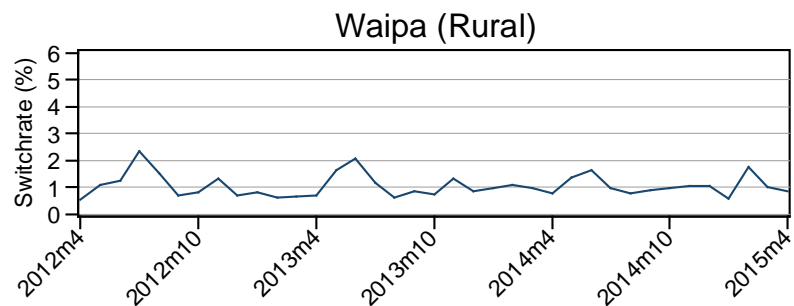
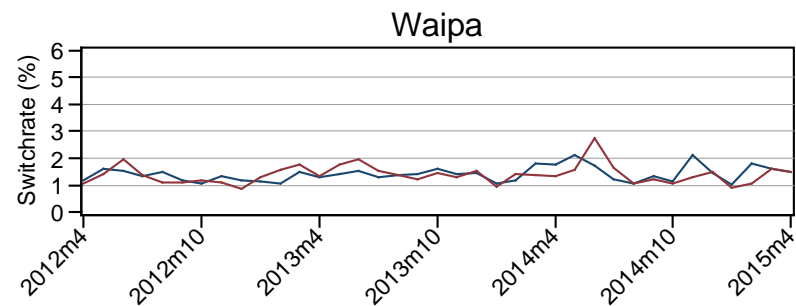
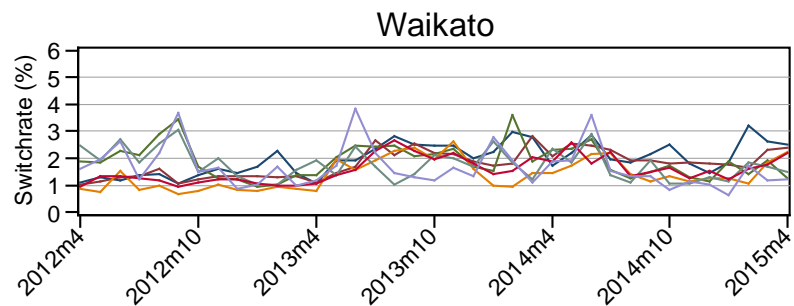
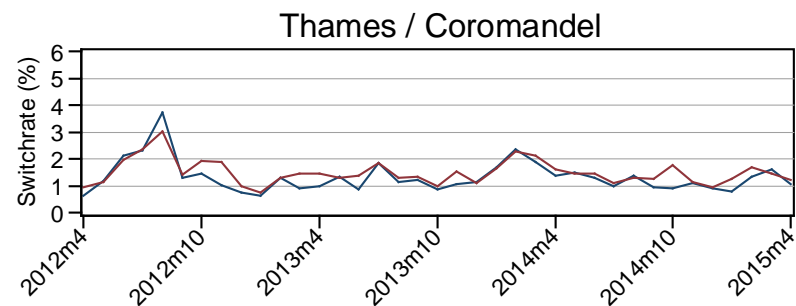
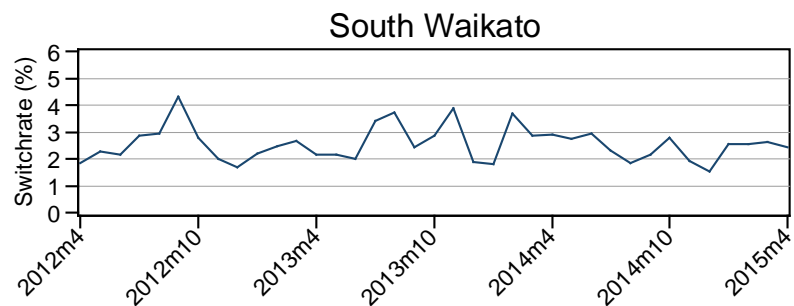
Switch rates by NSP Region: Taranaki / Whanganui (1/2)



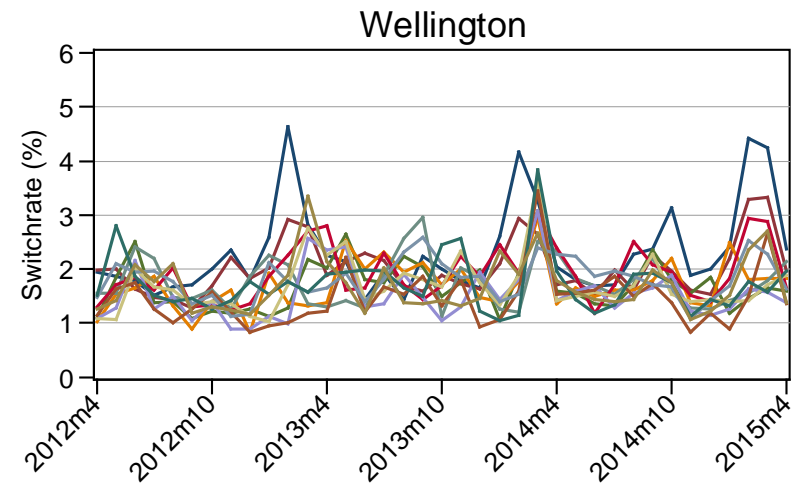
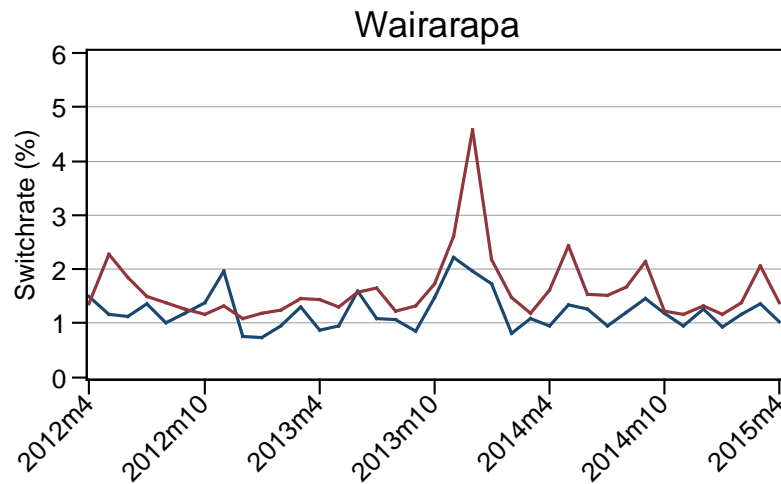
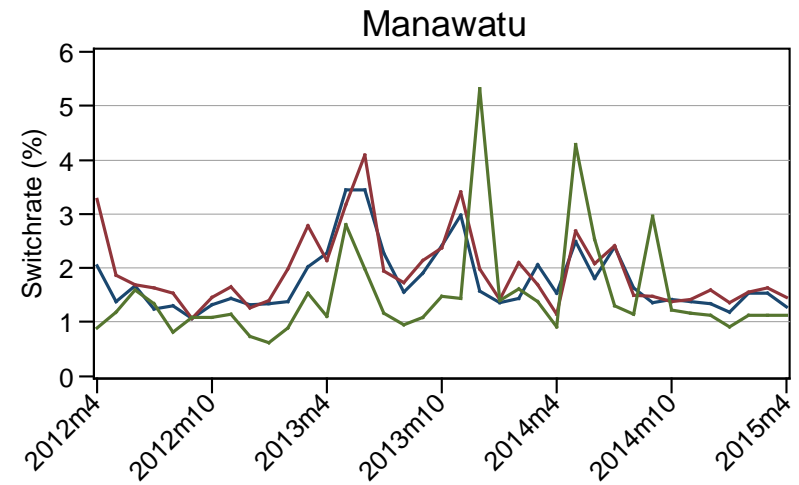
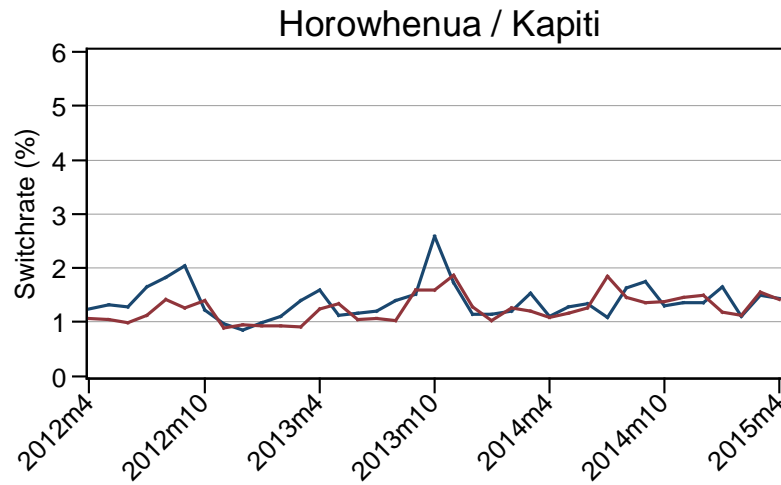
Switch rates by NSP Region: Taranaki / Whanganui (2/2)



Switch rates by NSP Region: Waikato / Coromandel



Switch rates by NSP Region: Wellington / Lower North Island



9.9 NSP Descriptions and Mappings

NSP Table			Powerswitch Website			Statistics New Zealand	
Root NSP	NSP Description	Network Reporting Region	Area Region ID	Area	Region	Area Unit Code	Area Unit Name
ABY0111ALPEGN	Albury	South Canterbury (Alpine Energy)	39	South Canterbury (Rural)	Canterbury	600323	Mackenzie
ALB0331UNETGN	Albany	Waitemata (Vector)	3	Auckland North / West	Auckland / Northland	508701	Albany
ALB1101UNETGN	Albany	Waitemata (Vector)	3	Auckland North / West	Auckland / Northland	508701	Albany
APS0111ORONGN	Arthurs Pass	Central Canterbury (Orion New Zealand)	5	Central Canterbury (Zone B)	Canterbury	587100	Malvern
ASB0331EASHGN	Ashburton	Ashburton (Electricity Ashburton)	1	Ashburton	Canterbury	597820	Ashburton Central West
ASB0661EASHGN	Ashburton	Ashburton (Electricity Ashburton)	1	Ashburton	Canterbury	597713	Ashburton North
ATU1101WPOWGN	Atarau	West Coast (Westpower)	64	Westland	Marlborough / Nelson / Westland	584933	Atarau
BAL0331OTPOGN	Balclutha	Otago (Otagonet Jv)	34	Otago	Otago / Southland	607400	Balclutha
BLN0331MARLGN	Blenheim	Marlborough (Marlborough Lines)	26	Marlborough	Marlborough / Nelson / Westland	580449	Rapaura
BOB0331COUPGN	Bombay	Counties (Counties Power)	10	Counties	Auckland / Northland	521160	Bombay
BOB1101COUPGN	Bombay	Counties (Counties Power)	10	Counties	Auckland / Northland	521160	Bombay
BPD1101ALPEGN	Bells Pond	South Canterbury (Alpine Energy)	39	South Canterbury (Rural)	Canterbury	600410	Waihao
BPE0331POCOGN	Bunnythorpe	Manawatu (Powerco)	25	Manawatu	Wellington / Lower North Island	560301	Stoney Creek
BRB0331NPOWGN	Bream Bay	Whangarei And Kaipara (Northpower)	33	Northland	Auckland / Northland	501815	Bream Bay
BRK0331POCOGN	Brunswick	Wanganui (Powerco)	65	Whanganui	Taranaki / Whanganui	555400	Maxwell
BRY0661ORONGN	Bromley	Central Canterbury (Orion New Zealand)	9	Christchurch	Canterbury	593900	Bromley
CBG0111WAIPGN	Cambridge	Waipa (Waipa Networks)	56	Waipa	Waikato / Coromandel	527133	Hautapu
CLH0111ORONGN	Castle Hill	Central Canterbury (Orion New Zealand)	5	Central Canterbury (Zone B)	Canterbury	587100	Malvern
CML0331DUNEGN	Cromwell	Central Otago (Aurora Energy)	7	Central Otago (Clyde / Cromwell - 15 kVA capacity)	Otago / Southland	608600	Cromwell
COL0111ORONGN	Coleridge	Central Canterbury (Orion New Zealand)	5	Central Canterbury (Zone B)	Canterbury	587100	Malvern

NSP Table			Powerswitch Website			Statistics New Zealand	
Root NSP	NSP Description	Network Reporting Region	Area Region ID	Area	Region	Area Unit Code	Area Unit Name
CPK0111CKHKGN	Central Park	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	573200	Aro Street-Nairn Street
CPK0331CKHKGN	Central Park	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	573200	Aro Street-Nairn Street
CST0331POCOGN	Carrington St	Taranaki (Powerco)	32	Northern Taranaki	Taranaki / Whanganui	552500	Struan Park
CUL0331MPOWGN	Culverden	North Canterbury (Mainpower Nz)	30	North Canterbury	Canterbury	585504	Culverden
CUL0661MPOWGN	Culverden	North Canterbury (Mainpower Nz)	30	North Canterbury	Canterbury	585504	Culverden
CYD0331DUNEGN	Clyde	Central Otago (Aurora Energy)	7	Central Otago (Clyde / Cromwell - 15 kVA capacity)	Otago / Southland	608303	Clyde
DOB0331WPOWGN	Dobson	West Coast (Westpower)	64	Westland	Marlborough / Nelson / Westland	584930	Dobson
DVK0111SCANGN	Dannevirke	Southern Hawke'S Bay (Scanpower)	42	Southern Hawkes Bay	Eastland / Hawkes Bay	549800	Norsewood-Herbertville
EDG0331HEDLGN	Edgecumbe	Eastern Bay Of Plenty (Horizon Energy)	13	Eastern Bay of Plenty	Bay of Plenty / Central North Island	542200	Edgecumbe
EDN0331TPCOGN	Edendale	Southland (The Power Company)	44	Southland (Rural - 20 kVA capacity)	Otago / Southland	609700	Edendale Community
FHL0331HAWKGN	Fernhill	Hawke'S Bay (Unison Networks)	17	Hawke's Bay	Eastland / Hawkes Bay	545842	Bridge Pa
FKN0331DUNEGN	Frankton	Queenstown (Aurora Energy)	35	Queenstown (15 kVA capacity)	Otago / Southland	609033	Frankton East
FKN0331LLNWGN	Frankton	Queenstown (Aurora Energy)	35	Queenstown (15 kVA capacity)	Otago / Southland	609033	Frankton East
GFD0331CKHKGN	Gracefield	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	568800	Gracefield
GLN0332COUPGN	Glenbrook	Counties (Counties Power)	10	Counties	Auckland / Northland	521152	Glenbrook
GLN0332NZSTGN	Glenbrook	Counties (Counties Power)	10	Counties	Auckland / Northland	521152	Glenbrook
GOR0331TPCOGN	Gore	Southland (The Power Company)	46	Southland (Urban - 20 kVA capacity)	Otago / Southland	610240	West Gore
GYM0661WPOWGN	Greymouth	West Coast (Westpower)	64	Westland	Marlborough / Nelson / Westland	585130	Greymouth Central

NSP Table			Powerswitch Website			Statistics New Zealand	
Root NSP	NSP Description	Network Reporting Region	Area Region ID	Area	Region	Area Unit Code	Area Unit Name
GYT0331POCOGN	Greytown	Wairarapa (Powerco)	58	Wairarapa	Wellington / Lower North Island	579900	Greytown
HAM0111WAIKGN	Hamilton	Waikato (Wel Networks)	55	Waikato	Waikato / Coromandel	527124	Newstead
HAM0331WAIKGN	Hamilton	Waikato (Wel Networks)	55	Waikato	Waikato / Coromandel	527124	Newstead
HAY0111CKHKGN	Haywards	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	569600	Haywards-Manor Park
HAY0331CKHKGN	Haywards	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	569600	Haywards-Manor Park
HEN0331UNETGN	Henderson	Waitemata (Vector)	3	Auckland North / West	Auckland / Northland	513631	Waimumu North
HEP0331UNETGN	Hepburn Road	Waitemata (Vector)	3	Auckland North / West	Auckland / Northland	514000	Freemans Bay
HEP0331VECTGN	Hepburn Road	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	514000	Freemans Bay
HIN0331POCOGN	Hinuera	Thames Valley (Powerco)	55	Waikato	Waikato / Coromandel	535242	Hinuera
HKK0661WPOWGN	Hokitika	West Coast (Westpower)	64	Westland	Marlborough / Nelson / Westland	585400	Hokitika Urban
HLY0331WAIKGN	Huntly	Waikato (Wel Networks)	55	Waikato	Waikato / Coromandel	527401	Huntly West
HOB1101VECTGN	Hobson Street	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	514101	Auckland Harbourside
HOR0331ORONGN	Hororata	Central Canterbury (Orion New Zealand)	5	Central Canterbury (Zone B)	Canterbury	587100	Malvern
HOR0661ORONGN	Hororata	Central Canterbury (Orion New Zealand)	5	Central Canterbury (Zone B)	Canterbury	587100	Malvern
HTI0331LINEGN	Hangatiki	King Country (The Lines Company)	57	Waipa (Rural)	Waikato / Coromandel	531731	Waipa Valley
HUI0331POCOGN	Huirangi	Taranaki (Powerco)	32	Northern Taranaki	Taranaki / Whanganui	551111	Lepperton
HWA0331POCOGN	Hawera	Taranaki (Powerco)	43	Southern Taranaki	Taranaki / Whanganui	554010	Hawera North
HWB0331DUNEGN	Halfway Bush	Dunedin (Aurora Energy)	11	Dunedin (15 kVA capacity)	Otago / Southland	603920	Halfway Bush
HWB0332DUNEGN	Halfway Bush	Dunedin (Aurora Energy)	11	Dunedin (15 kVA capacity)	Otago / Southland	603920	Halfway Bush
HWB1101OTPOGN	Halfway Bush	Dunedin (Aurora Energy)	11	Dunedin (15 kVA capacity)	Otago / Southland	603920	Halfway Bush
INV0331ELINGN	Invercargill	Invercargill (Electricity Invercargill)	19	Invercargill (20 kVA capacity)	Otago / Southland	611001	Waverley-Glengarry
INV0331TPCOGN	Invercargill	Southland (The Power Company)	19	Invercargill (20 kVA capacity)	Otago / Southland	611001	Waverley-Glengarry

NSP Table			Powerswitch Website			Statistics New Zealand	
Root NSP	NSP Description	Network Reporting Region	Area Region ID	Area	Region	Area Unit Code	Area Unit Name
ISL0331ORONGN	Islington	Central Canterbury (Orion New Zealand)	9	Christchurch	Canterbury	587830	Islington
ISL0661ORONGN	Islington	Central Canterbury (Orion New Zealand)	9	Christchurch	Canterbury	587830	Islington
KAI0111MPOWGN	Kaiapoi	North Canterbury (Mainpower Nz)	21	Kaiapoi	Canterbury	586503	Kaiapoi West
KAW0111HEDLGN	Kawerau	Eastern Bay Of Plenty (Horizon Energy)	13	Eastern Bay of Plenty	Bay of Plenty / Central North Island	542600	Kawerau
KBY0661ORONGN	Kimberley	Central Canterbury (Orion New Zealand)	5	Central Canterbury (Zone B)	Canterbury	587010	Kirwee
KIK0111TASMGN	Kikiwa	Tasman (Network Tasman)	50	Tasman	Marlborough / Nelson / Westland	581841	Golden Downs
KIN0331POCOGN	Kinleith	Thames Valley (Powerco)	41	South Waikato	Waikato / Coromandel	535212	Kinleith
KMO0331POCOGN	Kaitemako	Tauranga (Powerco)	52	Tauranga	Bay of Plenty / Central North Island	538301	Kaitemako
KOE1101TOPEGN	Kaikohe	Bay Of Islands (Top Energy)	31	Northern Northland	Auckland / Northland	501700	Kaikohe
KPU0661POCOGN	Kopu	Thames Valley (Powerco)	53	Thames / Coromandel	Waikato / Coromandel	533502	Parawai
KUM0661WPOWGN	Kumara	West Coast (Westpower)	64	Westland	Marlborough / Nelson / Westland	585306	Kumara
KWA0111CKHKGN	Kaiwharawhara	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	574500	Kaiwharawhara
LTN0331POCOGN	Linton	Manawatu (Powerco)	25	Manawatu	Wellington / Lower North Island	561902	Turitea
MCH0111TASMGN	Murchison	Tasman (Network Tasman)	50	Tasman	Marlborough / Nelson / Westland	581843	Murchison
MGM0331POCOGN	Mangamaire	Manawatu (Powerco)	25	Manawatu	Wellington / Lower North Island	577900	Mangatainoka
MHO0331ELECGN	Mangahao	Kapiti And Horowhenua (Electra)	18	Horowhenua / Kapiti	Wellington / Lower North Island	564021	Mangaore-Manakau
MLG0111CKHKGN	Melling	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	569201	Melling
MLG0331CKHKGN	Melling	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	569201	Melling

NSP Table			Powerswitch Website			Statistics New Zealand	
Root NSP	NSP Description	Network Reporting Region	Area Region ID	Area	Region	Area Unit Code	Area Unit Name
MNG0331VECTGN	Mangere	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	524530	Harania East
MPE1101NPOWGN	Maungatapere	Whangarei And Kaipara (Northpower)	33	Northland	Auckland / Northland	501810	Maungatapere
MST0331POCOGN	Masterton	Wairarapa (Powerco)	58	Wairarapa	Wellington / Lower North Island	578902	Solway South
MTM0331POCOGN	Mt. Maunganui	Tauranga (Powerco)	52	Tauranga	Bay of Plenty / Central North Island	536831	Arataki
MTN0331POCOGN	Marton	Wanganui (Powerco)	28	Marton / Bulls	Taranaki / Whanganui	559500	Marton
MTO0331NPOWGN	Maungaturoto	Whangarei And Kaipara (Northpower)	33	Northland	Auckland / Northland	504700	Maungaturoto
MTR0331POCOGN	Mataroa	Wanganui (Powerco)	48	Taihape/Waiouru	Taranaki / Whanganui	559220	Pohonui-Porewa
NMA0331TPCOGN	Nth Makarewa	Southland (The Power Company)	46	Southland (Urban - 20 kVA capacity)	Otago / Southland	609911	Makarewa North
NPK0331LINEGN	National Park	King Country (The Lines Company)	37	Raetihi	Taranaki / Whanganui	532602	National Park
NPL0331POCOGN	New Plymouth	Taranaki (Powerco)	32	Northern Taranaki	Taranaki / Whanganui	551400	Moturoa
NSY0331OTPOGN	Naseby	Otago (Otagonet Jv)	7	Central Otago (Clyde / Cromwell - 15 kVA capacity)	Otago / Southland	608100	Naseby
OAM0331WATAGN	Oamaru	Waitaki (Network Waitaki)	61	Waitaki	Otago / Southland	600812	Ardgowan
OKN0111LINEGN	Ohakune	King Country (The Lines Company)	37	Raetihi	Taranaki / Whanganui	555000	Ohakune
OKN0111POCOGN	Ohakune	Wanganui (Powerco)	37	Raetihi	Taranaki / Whanganui	555000	Ohakune
ONG0331LINEGN	Ongarue	King Country (The Lines Company)	22	King Country	Bay of Plenty / Central North Island	532700	Otangiwai-Heao
OPK0331POCOGN	Opunake	Taranaki (Powerco)	43	Southern Taranaki	Taranaki / Whanganui	553200	Opunake
ORO1101BUELGN	Orowaiti	Buller (Buller Electricity)	4	Buller	Marlborough / Nelson / Westland	584500	Westport Urban
ORO1102BUELGN	Orowaiti	Buller (Buller Electricity)	4	Buller	Marlborough / Nelson / Westland	584500	Westport Urban
OTA0221VECTGN	Otahuhu	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	523404	Grange
OTI0111WPOWGN	Otira	West Coast (Westpower)	64	Westland	Marlborough / Nelson / Westland	585315	Otira

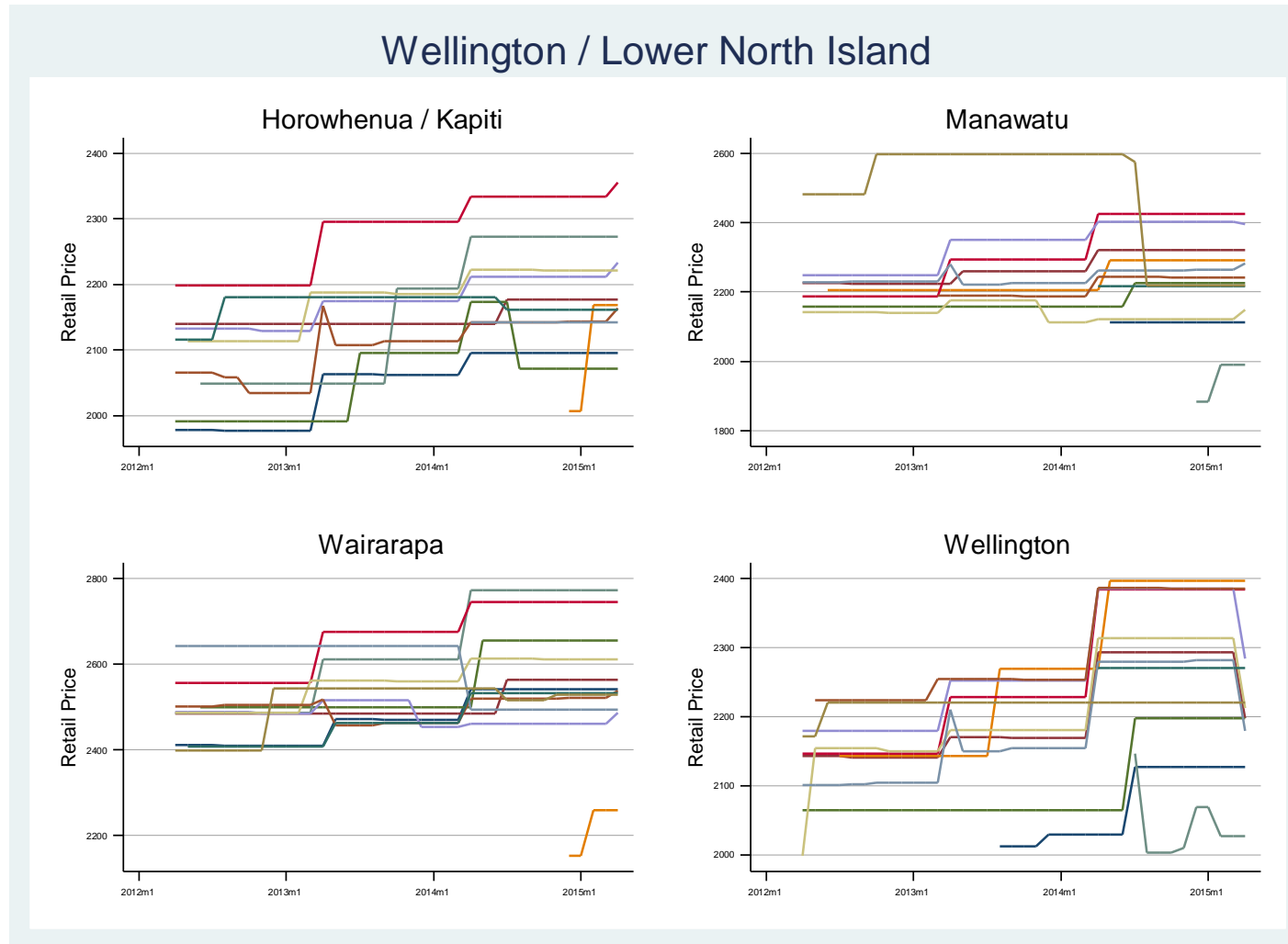
NSP Table			Powerswitch Website			Statistics New Zealand	
Root NSP	NSP Description	Network Reporting Region	Area Region ID	Area	Region	Area Unit Code	Area Unit Name
OWH0111HAWKGN	Owhata	Rotorua (Unison Networks)	38	Rotorua	Bay of Plenty / Central North Island	538742	Owhata East
PAK0331VECTGN	Pakuranga	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	523105	Golfland
PAO1101POCOGN	Piako 110Kv	Thames Valley (Powerco)	55	Waikato	Waikato / Coromandel	534902	Morrinsville East
PEN0221VECTGN	Penrose	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	520202	Ellerslie South
PEN0331VECTGN	Penrose	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	520202	Ellerslie South
PEN1101VECTGN	Penrose	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	520202	Ellerslie South
PNI0331CKHKGN	Pauatahanui	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	565601	Pauatahanui
PRM0331ELECGN	Paraparaumu	Kapiti And Horowhenua (Electra)	18	Horowhenua / Kapiti	Wellington / Lower North Island	566000	Paraparaumu Central
RDF0331HAWKGN	Redclyffe	Hawke'S Bay (Unison Networks)	17	Hawke's Bay	Eastland / Hawkes Bay	547300	Taradale South
RFN1101WPOWGN	Reefton	West Coast (Westpower)	4	Buller	Marlborough / Nelson / Westland	584701	Inangahua Valley
RFN1102WPOWGN	Reefton	West Coast (Westpower)	4	Buller	Marlborough / Nelson / Westland	584701	Inangahua Valley
ROS0221VECTGN	Mt. Roskill	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	518901	Lynfield North
ROS1101VECTGN	Mt. Roskill	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	518901	Lynfield North
ROT0111HAWKGN	Rotorua	Rotorua (Unison Networks)	38	Rotorua	Bay of Plenty / Central North Island	539800	Pomare
ROT0331HAWKGN	Rotorua	Rotorua (Unison Networks)	38	Rotorua	Bay of Plenty / Central North Island	539800	Pomare
SBK0331MPOWGN	Southbrook	North Canterbury (Mainpower Nz)	30	North Canterbury	Canterbury	586304	Southbrook
SDN0331DUNEGN	South Dunedin	Dunedin (Aurora Energy)	11	Dunedin (15 kVA capacity)	Otago / Southland	604410	South Dunedin
SFD0331POCOGN	Stratford	Taranaki (Powerco)	43	Southern Taranaki	Taranaki / Whanganui	553102	Stratford East

NSP Table			Powerswitch Website			Statistics New Zealand	
Root NSP	NSP Description	Network Reporting Region	Area Region ID	Area	Region	Area Unit Code	Area Unit Name
STK0331NELSGN	Stoke	Nelson (Nelson Electricity)	29	Nelson City	Marlborough / Nelson / Westland	583900	Isel Park
STK0331TASMGN	Stoke	Tasman (Network Tasman)	29	Nelson City	Marlborough / Nelson / Westland	583900	Isel Park
STK0661TASMGN	Stoke	Tasman (Network Tasman)	29	Nelson City	Marlborough / Nelson / Westland	583900	Isel Park
STU0111ALPEGN	Studholme	South Canterbury (Alpine Energy)	39	South Canterbury (Rural)	Canterbury	600410	Waihao
SVL0331UNETGN	Silverdale	Waitemata (Vector)	3	Auckland North / West	Auckland / Northland	506001	Weiti River
TAK0331VECTGN	Takanini	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	523912	Takanini South
TGA0111POCOGN	Tauranga	Tauranga (Powerco)	52	Tauranga	Bay of Plenty / Central North Island	537601	Greerton
TGA0331POCOGN	Tauranga	Tauranga (Powerco)	52	Tauranga	Bay of Plenty / Central North Island	537601	Greerton
TIM0111ALPEGN	Timaru	South Canterbury (Alpine Energy)	40	South Canterbury (Urban)	Canterbury	598700	Washdyke
TKA0331ALPEGN	Tekapo A	South Canterbury (Alpine Energy)	39	South Canterbury (Rural)	Canterbury	600320	Lake Tekapo
TKH0111HEDLGN	Te Kaha	Eastern Bay Of Plenty (Horizon Energy)	13	Eastern Bay of Plenty	Bay of Plenty / Central North Island	542901	Te Kaha
TKR0331CKHKGN	Takapu Road	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	573525	Takapu
TKU0331LINEGN	Tokaanu	King Country (The Lines Company)	51	Taupo	Bay of Plenty / Central North Island	541348	Tokaanu
TMI0331POCOGN	Te Matai	Tauranga (Powerco)	52	Tauranga	Bay of Plenty / Central North Island	536653	Rangiuru
TMK0331ALPEGN	Temuka	South Canterbury (Alpine Energy)	40	South Canterbury (Urban)	Canterbury	598600	Temuka
TMU0111WAIPGN	Te Awamutu	Waipa (Waipa Networks)	56	Waipa	Waikato / Coromandel	531003	Te Awamutu East
TRK0111HAWKGN	Tarukenga	Rotorua (Unison Networks)	38	Rotorua	Bay of Plenty / Central North Island	538863	Waiwhero
TUI0111EASTGN	Tuai	Eastland (Eastland Network)	60	Wairoa (Low Density)	Eastland / Hawkes Bay	545201	Tuai
TUI1101EASTGN	Tuia For East	Eastland (Eastland Network)	60	Wairoa (Low Density)	Eastland / Hawkes Bay	545201	Tuai

NSP Table			Powerswitch Website			Statistics New Zealand	
Root NSP	NSP Description	Network Reporting Region	Area Region ID	Area	Region	Area Unit Code	Area Unit Name
TWH0331WAIKGN	Te Kowhai	Waikato (Wel Networks)	55	Waikato	Waikato / Coromandel	527912	Te Kowhai
TWZ0331ALPEGN	Twizel	South Canterbury (Alpine Energy)	40	South Canterbury (Urban)	Canterbury	600100	Twizel Community
TWZ0331WATAGN	Twizel	Waitaki (Network Waitaki)	40	South Canterbury (Urban)	Canterbury	600100	Twizel Community
UHT0331CKHKGN	Upper Hutt	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	566620	Emerald Hill
WAI0111HEDLGN	Waiotahi	Eastern Bay Of Plenty (Horizon Energy)	13	Eastern Bay of Plenty	Bay of Plenty / Central North Island	542906	Waiotahi
WDV0111SCANGN	Woodville	Southern Hawke'S Bay (Scanpower)	42	Southern Hawkes Bay	Eastland / Hawkes Bay	550500	Woodville
WEL0331UNETGN	Wellsford	Waitemata (Vector)	3	Auckland North / West	Auckland / Northland	505300	Wellsford
WGN0331POCOGN	Wanganui	Wanganui (Powerco)	65	Whanganui	Taranaki / Whanganui	558300	Fordell-Kakatahi
WHU0331POCOGN	Waihou	Thames Valley (Powerco)	55	Waikato	Waikato / Coromandel	534604	Waihou-Walton
WIL0331CKHKGN	Wilton	Wellington (Wellington Electricity)	63	Wellington	Wellington / Lower North Island	574702	Wilton
WIR0331VECTGN	Wiri	Auckland (Vector)	2	Auckland Central / Manukau	Auckland / Northland	524604	Manukau Central
WKO0331POCOGN	Waikino	Thames Valley (Powerco)	53	Thames / Coromandel	Waikato / Coromandel	534200	Ohinemuri
WPR0331MPOWGN	Waipara	North Canterbury (Mainpower Nz)	30	North Canterbury	Canterbury	585700	Hurunui
WPR0661MPOWGN	Waipara	North Canterbury (Mainpower Nz)	30	North Canterbury	Canterbury	585700	Hurunui
WPT0111BUELGN	Westport	Buller (Buller Electricity)	4	Buller	Marlborough / Nelson / Westland	584410	Westport Rural
WPW0331CHBPGN	Waipawa	Central Hawke'S Bay (Centralines)	6	Central Hawkes Bay	Eastland / Hawkes Bay	549100	Waipawa
WRD0331UNETGN	Wairau Road	Waitemata (Vector)	3	Auckland North / West	Auckland / Northland	507900	Westlake
WRK0331HAWKGN	Wairakei	Taupo (Unison Networks)	51	Taupo	Bay of Plenty / Central North Island	541312	Wairakei-Aratiatia
WTK0331WATAGN	Waitaki	Waitaki (Network Waitaki)	61	Waitaki	Otago / Southland	600831	Aviemore
WTU0331HAWKGN	Whakatu	Hawke'S Bay (Unison Networks)	17	Hawke's Bay	Eastland / Hawkes Bay	545722	Whakatu
WVY0111POCOGN	Waverley	Wanganui (Powerco)	62	Waverley	Taranaki / Whanganui	554800	Waverley

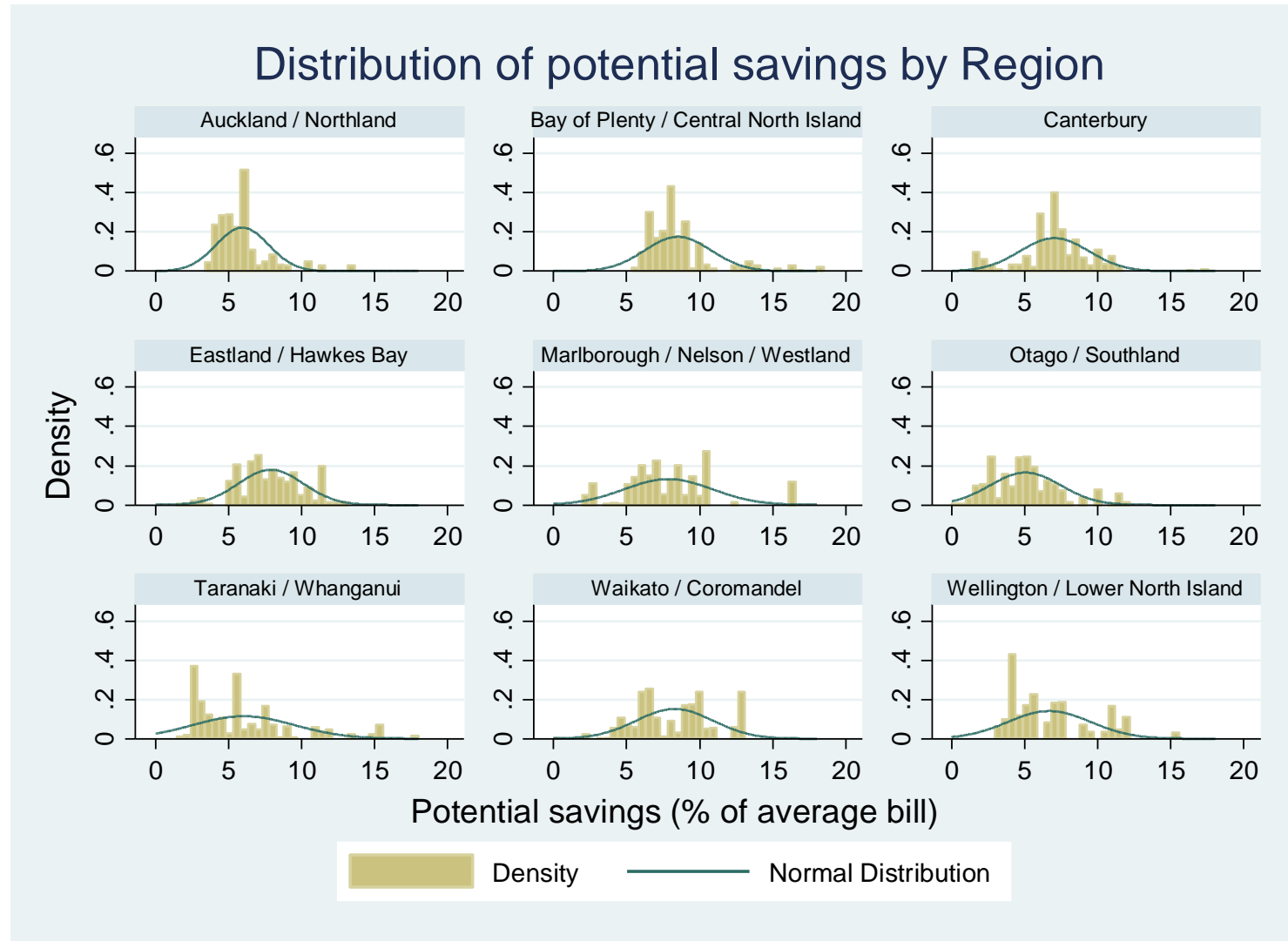
NSP Table			Powerswitch Website			Statistics New Zealand	
Root NSP	NSP Description	Network Reporting Region	Area Region ID	Area	Region	Area Unit Code	Area Unit Name
ADD0111ORONGN	Addington	Central Canterbury (Orion New Zealand)	9	Christchurch	Canterbury	594700	Addington
ADD0661ORONGN	Addington	Central Canterbury (Orion New Zealand)	9	Christchurch	Canterbury	594700	Addington
ANA0111LINEGN	Arohena	King Country (The Lines Company)	51	Taupo	Bay of Plenty / Central North Island	541320	Marotiri
BRY0111ORONGN	Bromley	Central Canterbury (Orion New Zealand)	9	Christchurch	Canterbury	593900	Bromley
DAR0111NPOWGN	Dargaville	Whangarei And Kaipara (Northpower)	33	Northland	Auckland / Northland	504600	Dargaville
GIS0501EASTGN	Gisbourne	Eastland (Eastland Network)	14	Eastland (High Density)	Eastland / Hawkes Bay	544600	Gisborne Central
KEN0331NPOWGN	Kensington	Whangarei And Kaipara (Northpower)	33	Northland	Auckland / Northland	502600	Kensington
MLN0661ORONGN	Middleton	Central Canterbury (Orion New Zealand)	9	Christchurch	Canterbury	590300	Middleton
MOT0111TASMGN	Motueka	Tasman (Network Tasman)	50	Tasman	Marlborough / Nelson / Westland	584303	Motueka East
MPI0661TASMGN	Motupipi	Tasman (Network Tasman)	50	Tasman	Marlborough / Nelson / Westland	581602	Takaka
PAL0331OTPOGN	Palmerston	Otago (Otagonet Jv)	61	Waitaki	Otago / Southland	601200	Palmerston
PAP0111ORONGN	Papanui	Central Canterbury (Orion New Zealand)	9	Christchurch	Canterbury	591900	Papanui
SPN0331ORONGN	Springston	Central Canterbury (Orion New Zealand)	5	Central Canterbury (Zone B)	Canterbury	597200	Lincoln
WRA0111EASTGN	Wairoa	Eastland (Eastland Network)	59	Wairoa (High Density)	Eastland / Hawkes Bay	545500	Wairoa

9.10 Example of Powerswitch Price Data



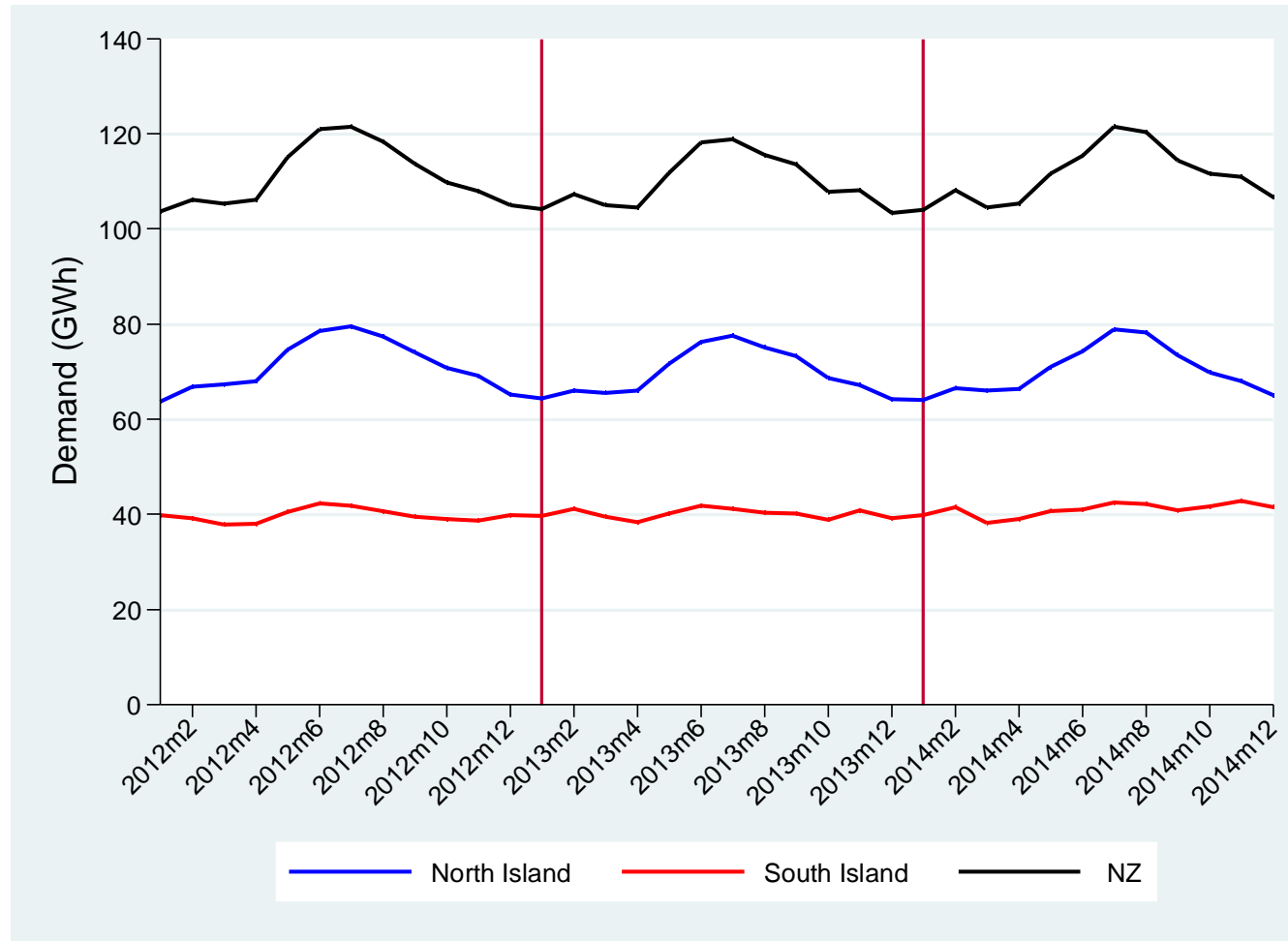
Example of the retailer price dataset for the Wellington / Lower North Island region. Each line represents the average annual cost that a medium sized household would face with a given retailer. Retailer labels have been excluded in the aim of saving space. We can note that prices generally move in a harmonious direction, but that significant differences exist across plans creating potential savings for consumers. Where prices are not available across all time periods this illustrates entry to the market, such as that by Flick in late 2014 to Wairarapa.

9.11 Distribution of Calculated Potential Savings by Region



We note that the average saving available is somewhere between 5-10%, though this differs across regions. Normal distribution overlaid for reference.

9.12 Month on Month Electricity Demand



Note the annual peak usage is in winter for the North Island and NZ (since it is dominated by the North Island demand). The South Island shows much more even usage but is slightly higher in winter months than autumn or spring. This is the motivation for our Winter dummy variable.



Genesis Energy Limited
Private Bag 3131
Waikato Mail Centre
Hamilton 3240
0800 300 400
Freefax 0800 110 999
genesisenergy.co.nz
info@genesisenergy.co.nz

Our Contact Centre hours are
Monday to Friday 8am to 8pm

MR A B SAMPLE
SAMPLE ADDRESS1
SAMPLE ADDRESS2
SAMPLE ADDRESS3
SAMPLE ADDRESS4 3210

COPY OF ORIGINAL INVOICE

Your Dual Fuel Account - Actual Reading

Summary of Payments Since Your Last Account

Closing Balance of Your Last Account	\$	244.04
Payments Received - Thank You!	\$	244.04 cr
Opening Balance	\$	0.00

Current Account Summary (refer over for details)

Current Electricity Charges	\$	370.59
Current Natural Gas Charges	\$	145.26
Other Transactions	\$	1.00
Prompt Payment Discount	\$	51.59 cr

Total Amount Due \$ 516.85

(If paid after due date 28 Nov 2014)

Discounted Amount Due \$ 465.26

(If paid by due date 28 Nov 2014)

Total Current GST Content \$67.28 (refer over for details)

Total Current GST Content After Prompt Payment Discount \$60.55

GST is calculated on each separate charge. Discounts only apply when total dual fuel account payment is received by the due date.

Your Consumer Number
200 000 0000

Customer Service
0800 300 400

Account Date
13 Nov 2014

Due Date
28 Nov 2014

GST Tax Invoice/Statement
Statement Number
2000000000

GST Number
71-067-769

Your Brownie Points

Opening Balance as at 13 Nov 2014
4480

Points earned this month
50

Closing Balance as at 13 Nov 2014
4530

Brownie Points to expire:
100 pts on 31 Dec 2014
To view rewards or an updated
balance login into My Account
at genesisenergy.co.nz

**Brownie Points is
coming to an end**



30th June 2015 is the last
day to redeem your points.

Find out more and see
what else we're putting
our energy into at
[genesisenergy.co.nz/
brownie-points](http://genesisenergy.co.nz/brownie-points) or check
your balance by logging
in to My Account.



Your Consumer Number
200 000 0000

MR A B SAMPLE
SAMPLE ADDRESS1
SAMPLE ADDRESS2
SAMPLE ADDRESS3
SAMPLE ADDRESS4 3210

Statement Number
2000000000

If it's easier, you can pay us via internet banking.
Please use the following details:

Bank: Westpac, Lambton Quay
Bank Account Number: 03-0502-0244320-000
Account Name: Genesis Energy
Reference Code: 2000000000

This is a copy of the
original remittance slip.
Please detach when
making payment.

Total Amount Due	\$	516.85
Discounted Amount Due (If paid by due date 28 Nov 2014)	\$	465.26

Amount Paid

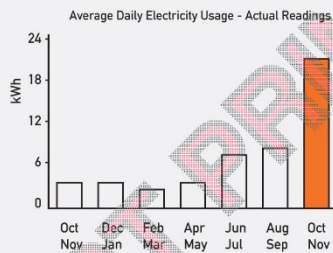
\$

1880: 00 2000000000: 0000000000: 0000046526



Your Consumer Number
200 000 0000

For Electricity Faults (24 hours) Call
WEL networks 0800 800 935



ICP Number 0000000002WE-222

Invoice Number 200000000

For electricity supply at **SAMPLE STREET, SAMPLE SUBURB, SAMPLE CITY**
Covers the **46 day** period from **29 Sep 2014** to **13 Nov 2014**
Your meter was read on **13 Nov 2014**

Current Electricity Usage

	Meter Number	Previous Reading	Current Reading	Read Type	Units Used	Rate	Total
Classic Anytime	09A066365	8770	9802	Actual	1032 @	29.74 c/unit	306.92
Daily Fixed Charge					46 days @	33.33 c/day	15.33
Sub Total							322.25
GST							48.34
TOTAL CURRENT ELECTRICITY CHARGES							\$ 370.59

Your average daily electricity cost for this billing period excluding discount is **\$8.06 incl GST**.

Thank you for your payment.

Please make cheque payable to Genesis Energy. Please return this portion with your payment in the reply paid envelope or post to **Private Bag 39999, Wellington Mail Centre, Lower Hutt 5045**.

If you have any concerns about our service or wish to lodge a complaint, please call us on **0800 300 400** to access our free complaints process. Or you can email us at customercomplaints@genesisenergy.co.nz.

If we are unable to resolve your complaint, you can also call the free independent dispute resolution service provided by the Electricity and Gas Complaints Commissioner on 0800 22 33 40 or visit www.egcomplaints.co.nz.

Statement/Tax Invoice

GST Number 71 048 870

Mr & Mrs Sample
1 Sample Rd
RD 1
Waharoa 1234

**Mercury Energy**

*Mighty River Power Limited
trading as Mercury Energy*

For account enquiries phone 0800 20 18 20 (8am - 6pm Mon to Fri)

Your account number**123-456-789****Recent transactions**

15 Oct 10 Opening balance
15 Oct 10 Payment received via RD1

\$662.10

\$662.10cr

Balance**\$0.00****Current account summary**

Net current charges

\$588.53

GST

\$88.28

Total current charges (please see Current account details)

\$676.81

Amount due**\$676.81**

The following additional discount is included in this bill :

RD1 Supplier partner rebate**\$83.56**

Please refer to the Current account details section(s) of your bill.

Invoice date

15 October 2010

Billing period16 September 2010 to
15 October 2010**Date of next invoice
(approx.)**

15 November 2010

FAULTS - For all faults phone 0800 2 FAULTS (0800 232 8587)

Page 1

Account name Mr & Mrs Sample
Account number 123-456-789

Detailed electricity account for your information only.

Please DO NOT pay Mercury Energy directly.

Your RD1 Supplier statement will include
the above amount of \$676.81

**Mercury Energy**

Private Bag 92008
Auckland

Meter reading(s) - For the period 16 Sep 10 to 15 Oct 10

The next approximate date we will read your meter is 15 November 2010

Price plan	This reading	Last reading	Units used
Standard - Anytime	21120 (actual)	20185 (actual)	935 kWh

Current account details - For the period 16 Sep 10 to 15 Oct 10

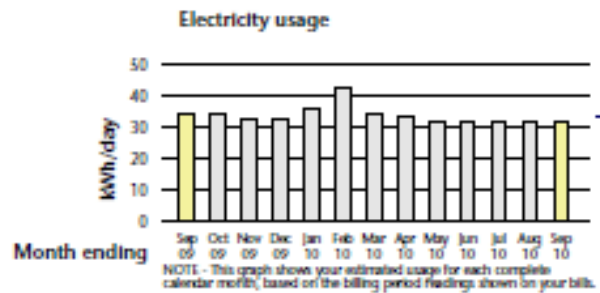
Charge type	Units	Mercury Energy		Vector Limited	
Variable usage charge					
Standard - Anytime	935 kWh	@ 10.58 cents/kWh	\$98.92	@ 10.47 cents/kWh	\$97.89
Daily fixed charge	30 days	@ 73.69 cents/day	\$22.11	@ 16.67 cents/day	\$5.00
Metering	30 days	@ 10.63 cents/day	\$3.19		
Electricity Authority levy	935 kWh	@ 0.20 cents/kWh	\$1.87		
Subtotals			\$126.09		\$102.89
GST			\$18.91		\$15.43
Totals			\$145.00		\$118.32
Discount for prompt payment *			\$14.50cr		\$11.83cr

Total current charges (Mercury Energy plus Vector Limited)

\$263.32

Usage Information

Cost per day for the period(s) shown above _____ \$8.78/day

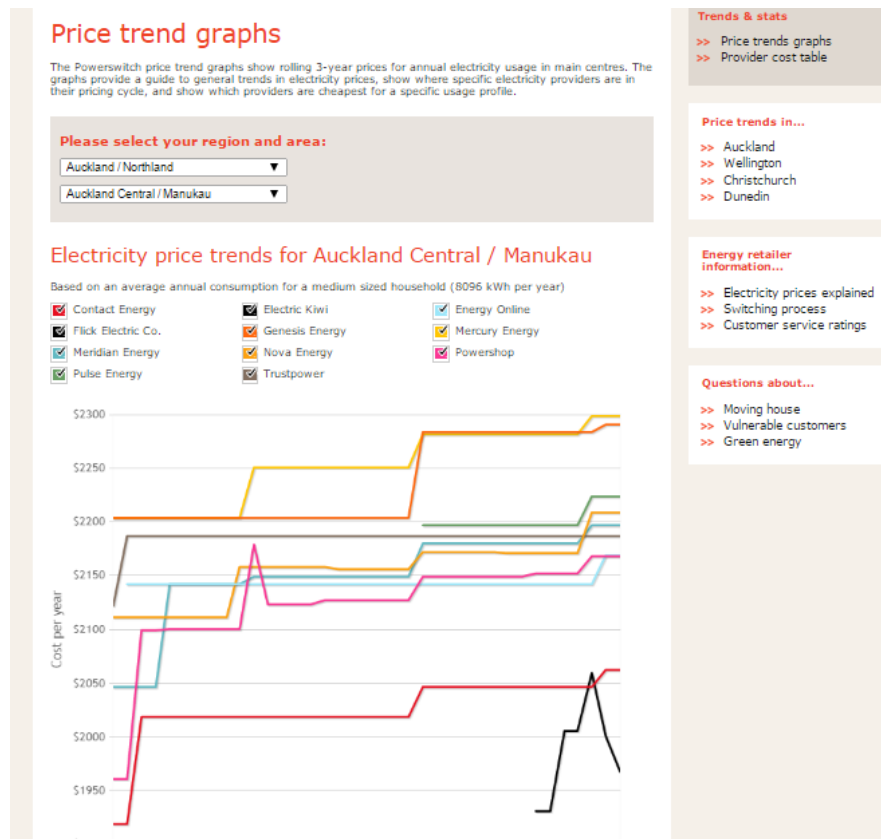


* Retained by Mercury Energy if not paid by the discount expiry date.

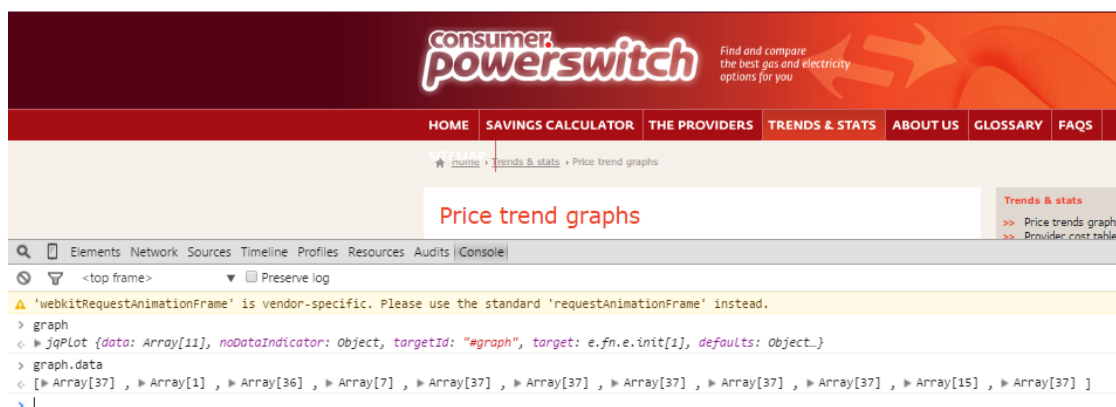
9.14 Pricing Data Collection

The Consumer NZ Powerswitch website displays the retailer prices for the current month and previous 36 months for each area-region (of which they break NZ into 56). The data is embedded behind an interactive Javascript graph on the webpage. The data can be called from the command line in chrome. We then apply a Javascript routine in the console line to extract this data down to a csv (comma separated values) file that we can reshape in Excel. This is repeated for each area region manually as the graph will not update to automated selection of the drop down menus on area and region selection.

We reshape these area-region datasets in Excel using VBA (Visual Basic for Applications). One script formats each csv file and another compiles them into a master spreadsheet. Once this process is complete the dataset can be imported into Stata which we then save as our base price dataset. Javascript and VBA scripts are on the following pages.



The Powerswitch website and Javascript pricing graph (jqPlot)



The console line of Chrome calling the graph and the dataset behind the graph

Javascript Routine

```
graph

function exportToCsv(filename, rows) {
    var processRow = function (row) {
        var finalVal = '';
        for (var j = 0; j < row.length; j++) {
            var innerValue = row[j] === null ? '' : row[j].toString();
            if (row[j] instanceof Date) {
                innerValue = row[j].toLocaleString();
            };
            var result = innerValue.replace(/"/g, '""');
            if (result.search(/("|,|\n)/g) >= 0)
                result = '"' + result + '"';
            if (j > 0)
                finalVal += ',';
            finalVal += result;
        }
        return finalVal + '\n';
    };

    var csvFile = '';
    for (var i = 0; i < rows.length; i++) {
        csvFile += processRow(rows[i]);
    }

    var blob = new Blob([csvFile], { type: 'text/csv;charset=utf-8;' });
    if (navigator.msSaveBlob) { // IE 10+
        navigator.msSaveBlob(blob, filename);
    } else {
        var link = document.createElement("a");
        if (link.download !== undefined) { // feature detection
            // Browsers that support HTML5 download attribute
            var url = URL.createObjectURL(blob);
            link.setAttribute("href", url);
            link.setAttribute("download", filename);
            link.style = "visibility:hidden";
            document.body.appendChild(link);
            link.click();
            document.body.removeChild(link);
        }
    }
}

mydata = graph.data;
graphleg = graph.legend.labels
var ss=document.getElementById("region");
var tt=document.getElementById("area")
reg = ss.options[ss.selectedIndex].text
ar = tt.options[tt.selectedIndex].text

for (z = 0; z < graphleg.length; z++) {
    mydata[z].unshift(graphleg[z]);
    mydata[z].unshift(ar);
    mydata[z].unshift(reg);}

var name = "Export --"+reg+" -- "+ar+".csv";
exportToCsv(name,mydata);

location.reload()
```

VBA Formatting Script

```
Sub compiler2()

    'Change to the correct folder path, be sure to include the ending \
    Const strFolderPath As String = "C:\Users\Andrew\Desktop\PS Exports\20150407 - Copy\"

    Dim strCurrentFile As String
    strCurrentFile = Dir(strFolderPath & "*.csv")

    Application.ScreenUpdating = False
    Application.DisplayAlerts = False

    Do
        With Workbooks.Open(strFolderPath & strCurrentFile)
            .Sheets(1).Range("A1").Activate
            Call compiler1
            .Save
            .Close True
        End With
        strCurrentFile = Dir
    Loop While Len(strCurrentFile) > 0

    Application.ScreenUpdating = True
    Application.DisplayAlerts = True

End Sub

Sub Formulas()
    '
    ActiveCell.Rows("1:1").EntireRow.Select
    Selection.Insert Shift:=xlDown, CopyOrigin:=xlFormatFromLeftOrAbove
    ActiveCell.Select
    ActiveCell.Offset(1, 0).Select
    lastcol = ActiveCell.End(xlToRight).Column

    lastcol = Col_Letter(lastcol)

    'MsgBox (lastcol)
    ActiveCell.Offset(-1, 0).Select
    ActiveCell.FormulaR1C1 = "=RIGHT(R[1]C,4)"
    ActiveCell.Select
    Selection.AutoFill Destination:=ActiveCell.Range("A1:" & lastcol & "1"), Type:= _
        xlFillDefault
    ActiveCell.Offset(2, 0).Select
End Sub

Function Col_Letter(lngCol) As String
    Dim vArr
    vArr = Split(Cells(1, lngCol).Address(True, False), "$")
    Col_Letter = vArr(0)
End Function

Sub Copyr()
    Range(Cells.Address).Select
    Application.CutCopyMode = False
    Selection.Copy
    Selection.PasteSpecial Paste:=xlPasteAllUsingSourceTheme, Operation:=xlNone _
        , SkipBlanks:=False, Transpose:=False
    Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
        :=False, Transpose:=False
End Sub

Sub DeleteAlternateRow()
    Range("A1").Activate
    lastrow = ActiveCell.End(xlDown).Row
    For i = 2 To lastrow
        Cells(i, 1).Select
        ActiveCell.EntireRow.Delete
    Next i
End Sub

Sub dural()
    Dim N As Long, L As Long
    N = Cells(Rows.Count, "A").End(xlUp).Row
    For L = 1 To N
        While Cells(L, "AK") = ""
            Cells(L, 1).Insert (xlShiftToRight)
        Wend
    Next L
End Sub
```

```

Sub compiler1()
    Dim Sh As Worksheet
    Set Sh = ActiveSheet
    Range("A1").Activate
    lastrow = ActiveCell.End(xlDown).Row
    Range("A1:C" & lastrow).Select
    Range(Selection, Selection.End(xlDown)).Select
    Selection.Copy
    Sheets.Add After:=ActiveSheet
    ActiveSheet.Paste
    Sh.Select
    Application.CutCopyMode = False
    Selection.Delete Shift:=xlToLeft

    Range("a1").Select

    startcell = Range("A1")

    Do Until IsEmpty(startcell)
        Call Formulas
        startcell = ActiveCell
    Loop

    Call Copyr
    Call DeleteAlternateRow
    Call dural

    Sheets("Sheet1").Select
    Range("A1").Select
    lastrow2 = ActiveCell.End(xlDown).Row
    Range("A1:C" & lastrow2).Select
    Selection.Copy
    Sh.Select
    Columns("A:A").Select
    Selection.Insert Shift:=xlToRight
    Range("A1").Activate

    Sheets("Sheet1").Delete
End Sub

```

VBA Compile to Master Spreadsheet Script

```
Option Explicit
Sub CombineDataFiles()

Dim DataBook As Workbook, OutBook As Workbook
Dim DataSheet As Worksheet, OutSheet As Worksheet
Dim TargetFiles As FileDialog
Dim MaxNumberFiles As Long, FileIdx As Long, _
    LastDataRow As Long, LastDataCol As Long, _
    HeaderRow As Long, LastOutRow As Long
Dim DataRng As Range, OutRng As Range

'initialize constants
MaxNumberFiles = 2001
HeaderRow = 1 'assume headers are always in row 1
LastOutRow = 1

'prompt user to select files
Set TargetFiles = Application.FileDialog(msoFileDialogOpen)
With TargetFiles
    .AllowMultiSelect = True
    .Title = "Multi-select target data files:"
    .ButtonName = ""
    .Filters.Clear
    .Filters.Add ".csv files", "*.csv"
    .Show
End With

'error trap - don't allow user to pick more than 2000 files
If TargetFiles.SelectedItems.Count > MaxNumberFiles Then
    MsgBox ("Too many files selected, please pick more than " & MaxNumberFiles & ". Exiting sub...")
    Exit Sub
End If

'set up the output workbook
Set OutBook = Workbooks.Add
Set OutSheet = OutBook.Sheets(1)

'loop through all files
For FileIdx = 1 To TargetFiles.SelectedItems.Count

    'open the file and assign the workbook/worksheet
    Set DataBook = Workbooks.Open(TargetFiles.SelectedItems(FileIdx))
    Set DataSheet = DataBook.ActiveSheet

    'identify row/column boundaries
    LastDataRow = DataSheet.Cells.Find(" ", SearchOrder:=xlByRows, SearchDirection:=xlPrevious).Row
    LastDataCol = DataSheet.Cells.Find(" ", SearchOrder:=xlByColumns, SearchDirection:=xlPrevious).Column

    'if this is the first go-round, include the header
    If FileIdx = 1 Then
        Set DataRng = Range(DataSheet.Cells(HeaderRow, 1), DataSheet.Cells(LastDataRow, LastDataCol))
        Set OutRng = Range(OutSheet.Cells(HeaderRow, 1), OutSheet.Cells(LastDataRow, LastDataCol))
        'if this is NOT the first go-round, then skip the header
    Else
        Set DataRng = Range(DataSheet.Cells(HeaderRow, 1), DataSheet.Cells(LastDataRow, LastDataCol))
        Set OutRng = Range(OutSheet.Cells(LastOutRow + 1, 1), OutSheet.Cells(LastOutRow + 1 + LastDataRow,
LastDataCol))
    End If

    'copy the data to the outbook
    DataRng.Copy OutRng

    'close the data book without saving
    DataBook.Close False

    'update the last outbook row
    LastOutRow = OutSheet.Cells.Find(" ", SearchOrder:=xlByRows, SearchDirection:=xlPrevious).Row

Next FileIdx

'let the user know we're done!
MsgBox ("Combined " & TargetFiles.SelectedItems.Count & " files!")

End Sub
```

9.15 Stata Code

```
*****
*****/
// total do file for my empirical project
// all datasets are created from raw data except the pricing dataset and the NSP Description and Mapping
dataset
// the NSP Desc dataset is the base dataset and contains my mappings from NSPs to Powerswitch price data and
Stats NZ data as outlined in table 9.9 of the report
// the pricing data set AllPriceData_Base is the output of the combined pricing master file from the
Javascript and VBA scripts outlined in appendix 9.14
/*****
*****/

// the only thing that needs to be changed is to set the base directory to find the files
/*****
*****/
global direct = "J:\desktop\726 Project Executable" //<----- change
this to where you download the folder
/*****
*****/

// switching dataset
clear
import delimited "$direct\Raw Datasets\Switching_trends_20150619152844.csv", ///
delimiter(comma) rowrange(13)

// rename variables
rename v1 monthstart
drop v2
rename v3 rootnsp
drop v4
rename v5 avgicp
rename v6 switches
rename v7 switchrate

label var rootnsp "Root NSP"
label var avgicp "Avg. attached ICPs"
label var switches Switches
label var switchrate "Switch Rate"
format switchrate %9.2g

/*****
*****/
// fix data errors in spreadsheet
/*****
*****/
// appears to be issue with average icps and thus the calculated switchrate in eastern BOP for 2013m3

// incorrect average icp for KAW0111HEDLGN in 2013m3 resulting in outlier switchrate
// average icp is missing leading 2 so should be circa 2900 not 900.
// this is confirmed by looking up in the market share report by the EA where
// the total icps is circa 2900
replace avgicp = 2935 if rootnsp == "KAW0111HEDLGN" & monthstart == "01/03/2013"
replace switchrate = switches/avgicp*100 if rootnsp == "KAW0111HEDLGN" & monthstart == "01/03/2013"

// incorrect average icp for EDG0331HEDLGN in 2013m3 resulting in outlier switchrate
// average icp is stated as 4745 but for every other month is around 16100
// market share report lists the total icp as 16153
// we restate this in our switching rate calculations
replace avgicp = 16153 if rootnsp == "EDG0331HEDLGN" & monthstart == "01/03/2013"
replace switchrate = switches/avgicp*100 if rootnsp == "EDG0331HEDLGN" & monthstart == "01/03/2013"

// incorrect average icp for TKH0111HEDLGN in 2013m3 resulting in outlier switchrate
// average icp is stated as 114 but for every other month is around 1016
// market share report lists the total icp as 1013
// we restate this in our switching rate calculations
replace avgicp = 1013 if rootnsp == "TKH0111HEDLGN" & monthstart == "01/03/2013"
replace switchrate = switches/avgicp*100 if rootnsp == "TKH0111HEDLGN" & monthstart == "01/03/2013"

// incorrect average icp for WAI0111HEDLGN in 2013m3 resulting in outlier switchrate
// average icp is stated as 4244 but for every other month is around 4250
// market share report lists the total icp as 1013
// we restate this in our switching rate calculations
replace avgicp = 4244 if rootnsp == "WAI0111HEDLGN" & monthstart == "01/03/2013"
replace switchrate = switches/avgicp*100 if rootnsp == "WAI0111HEDLGN" & monthstart == "01/03/2013"

// appears to be similar issue in Northern Taranaki for 2013m3 though less extreme
/*****
*****/
// incorrect average icp for CST0331POCOGN in 2013m3 resulting in outlier switchrate
// average icp is stated as 16111 but for every other month is around 20000
// market share report lists the total icp as 20361
// we restate this in our switching rate calculations
```

```

replace avgicp = 20361 if rootnsp == "CST0331POCOGN" & monthstart == "01/03/2013"
replace switchrate = switches/avgicp*100 if rootnsp == "CST0331POCOGN" & monthstart == "01/03/2013"

// incorrect average icp for HUI0331POCOGN in 2013m3 resulting in outlier switchrate
// average icp is stated as 5493 but for every other month is around 6800
// market share report lists the total icp as 6836
// we restate this in our switching rate calculations
replace avgicp = 6836 if rootnsp == "HUI0331POCOGN" & monthstart == "01/03/2013"
replace switchrate = switches/avgicp*100 if rootnsp == "HUI0331POCOGN" & monthstart == "01/03/2013"

// incorrect average icp for NPL0331POCOGN in 2013m3 resulting in outlier switchrate
// average icp is stated as 6781 but for every other month is around 8600
// market share report lists the total icp as 8589
// we restate this in our switching rate calculations
replace avgicp = 8589 if rootnsp == "NPL0331POCOGN" & monthstart == "01/03/2013"
replace switchrate = switches/avgicp*100 if rootnsp == "NPL0331POCOGN" & monthstart == "01/03/2013"

// appears to be similar issue in South Taranaki for 2013m3 though less extreme
/*****/
// incorrect average icp for HWA0331POCOGN in 2013m3 resulting in outlier switchrate
// average icp is stated as 8097 but for every other month is around 9120
// market share report lists the total icp as 9112
// we restate this in our switching rate calculations
replace avgicp = 9112 if rootnsp == "HWA0331POCOGN" & monthstart == "01/03/2013"
replace switchrate = switches/avgicp*100 if rootnsp == "HWA0331POCOGN" & monthstart == "01/03/2013"

// incorrect average icp for OPK0331POCOGN in 2013m3 resulting in outlier switchrate
// average icp is stated as 2875 but for every other month is around 3030
// market share report lists the total icp as 3028
// we restate this in our switching rate calculations
replace avgicp = 3028 if rootnsp == "OPK0331POCOGN" & monthstart == "01/03/2013"
replace switchrate = switches/avgicp*100 if rootnsp == "OPK0331POCOGN" & monthstart == "01/03/2013"

// incorrect average icp for SFD0331POCOGN in 2013m3 resulting in outlier switchrate
// average icp is stated as 7256 but for every other month is around 8200
// market share report lists the total icp as 8201
// we restate this in our switching rate calculations
replace avgicp = 8201 if rootnsp == "SFD0331POCOGN" & monthstart == "01/03/2013"
replace switchrate = switches/avgicp*100 if rootnsp == "SFD0331POCOGN" & monthstart == "01/03/2013"

// create month variable
gen d=date(monthstart, "DMY", 2010)
format d %td

gen month = mofd(d)
drop d
drop monthstart
format month %tm
label var month Month

encode rootnsp, gen(nspid)
sort nspid month

// set panel structure
xtset nspid month

// specify observation period to match price data
drop if month < ym(2012, 4)
drop if month > ym(2015, 4)

save "$direct\Switching.dta", replace

/*****/

// demand dataset
clear
import delimited "$direct\Raw Datasets\Grid_demand_trends_20150619161949.csv", delimiter(comma) rowrange(14)

// rename variables
rename v1 date
drop v2 v3 v5
rename v4 rootnspshort
rename v6 demand
label var demand "Demand (GWh)"
label var rootnspshort "Root NSP Short"

// sort out date variable
gen d=date(date, "DMY", 2010)
format d %td

```

```

gen month = mofd(d)
drop d date
format month %tm
label var month Month

// specify observation period to match price data
drop if month < ym(2012, 4)
drop if month > ym(2015, 4)

save "$direct\Demand.dta", replace

/*****
*****/
// stats NZ age dataset
// creates median age for each area unit and two portion variables
// 1. portion of individuals aged 20-30
// 2. portion of individuals aged 60+
clear
import delimited "$direct\Raw Datasets\2013-mb-dataset-Total-New-Zealand-Individual-Part-1.csv"

set more off

// remove footnotes
keep in 1/49011

// drop all variables apart from 2006 and 2013 age variables in question and the area identifiers
keep area_code_and_description code description v39 v40 v47 v48 v49 v50 v55 v56 v63 v64 v65 v66

// rename variables
rename v39 pop20_2006
rename v40 pop25_2006
rename v47 pop60_2006
rename v48 pop65_2006
rename v49 totpop_2006
rename v50 medage_2006
rename v55 pop20_2013
rename v56 pop25_2013
rename v63 pop60_2013
rename v64 pop65_2013
rename v65 totpop_2013
rename v66 medage_2013
rename code AUcode
label var AUcode "Area Unit Code"
label var medage_2006 "Median Age, 2006"
label var medage_2013 "Median Age, 2013"

// create list of area unit data we want to keep based on the NSP to Area Unit Mapping
local arealist
600323,508701,587100,597820,597713,584933,607400,580449,521160,600410,560301,501815,555400,593900,527133,6086
00,573200,552500,585504,608303,584930,549800,542200,609700,545842,609033,568800,521152,610240,585130,579900,5
27124,569600,513631,514000,535242,585400,527401,514101,531731,551111,554010,603920,611001,587830,586503,54260
0,587010,581841,535212,538301,501700,533502,585306,574500,561902,581843,577900,564021,569201,524530,501810,57
8902,536831,559500,504700,559220,609911,532602,551400,608100,600812,555000,532700,553200,584500,523404,585315
,538742,523105,534902,520202,565601,566000,547300,584701,518901,539800,586304,604410,553102,583900,506001,523
912,537601,598700,600320,542901,573525,541348,536653,598600,531003,538863,545201,527912,600100,566620,542906,
550500,505300,558300,534604,574702,524604,534200,585700,584410,549100,507900,541312,600831,545722,554800,5947
00,541320,504600,544600,502600,590300,584303,581602,601200,591900,597200,545500
keep if inlist(AUcode, `arealist')
// clears out remaining meshblock data that has areacodes missing a leading zero so get mixed up with area
units
drop if strpos(area_code_and_description, "MB")!=0

// apply formatting to make data more readable
drop area_code_and_description description
destring pop20_2006 pop25_2006 pop60_2006 pop65_2006 medage_2006 ///
pop20_2013 pop25_2013 pop60_2013 pop65_2013 medage_2013, replace

// create portion variables
gen portpop60_2006 = (pop60_2006 + pop65_2006) / totpop_2006
gen portpop60_2013 = (pop60_2013 + pop65_2013) / totpop_2013
label var portpop60_2006 "Portion of population 60+, 2006"
label var portpop60_2013 "Portion of population 60+, 2013"

gen portpop2030_2006 = (pop20_2006 + pop25_2006) / totpop_2006
gen portpop2030_2013 = (pop20_2013 + pop25_2013) / totpop_2013
label var portpop2030_2006 "Portion of population 20-29, 2006"
label var portpop2030_2013 "Portion of population 20-29, 2013"

drop pop20_2006 pop25_2006 pop60_2006 pop65_2006 totpop_2006 ///
pop20_2013 pop25_2013 pop60_2013 pop65_2013 totpop_2013

```



```

// convert to panel shape
reshape long medage_ portpop60_ portpop2030_ , i(AUcode) j(year)

// create duplicates for timeseries components
expand 26 if year == 2013
sort AUcode year
expand 11 if year == 2006
sort AUcode year

// generate month dates
gen date = .

local datelist
41000,41030,41061,41091,41122,41153,41183,41214,41244,41275,41306,41334,41365,41395,41426,41456,41487,41518,4
1548,41579,41609,41640,41671,41699,41730,41760,41791,41821,41852,41883,41913,41944,41974,42005,42036,42064,
42095
matrix input DATELIST = (`datelist')
local ColDATELIST = colsof(DATELIST)

forval k = 1/`ColDATELIST' {
    foreach i of num `k'(37)5032 {
        replace date = DATELIST[1,`k'] in `i'
    }
}

gen statadate = date + td(30dec1899)
format statadate %td

drop date
rename statadate date

gen month = mofd(date)
drop date
format month %tm

// set panel dataset
xtset AUcode month

// final touches
rename year censusdatayr
sort AUcode month
label var month Month
label var medage_ "Median Age"
label var portpop60_ "Population 60+"
rename portpop60_ portpop60
label var portpop2030_ "Population 20-29"
rename portpop2030_ portpop2030
format portpop2030 portpop60 %9.2g
rename medage_ medage
label var censusdatayr "Census Dataset"

// save dataset
save "$direct\Age.dta", replace

/*****
*****/
// stats NZ education dataset
// creates portion variable for bachelors education or greater
clear
import delimited "$direct\Raw Datasets\2013-mb-dataset-Total-New-Zealand-Individual-Part-2.csv"

set more off

// remove footnotes
keep in 1/49011

// drop all variables apart from 2006 and 2013 education variables in question and the area identifiers
keep area_code_and_description code description v131 v132 v133 v134 v136 v145 v146 v147 v148 v150

// rename variables
rename v131 bach_2006
rename v132 postg_2006
rename v133 masters_2006
rename v134 doct_2006
rename v136 total_2006

rename v145 bach_2013
rename v146 postg_2013
rename v147 masters_2013

```

```

rename vl48 doct_2013
rename vl50 total_2013

rename code AUcode
label var AUcode "Area Unit Code"

// create list of area unit data we want to keep based on the NSP to Area Unit Mapping
local arealist
600323,508701,587100,597820,597713,584933,607400,580449,521160,600410,560301,501815,555400,593900,527133,6086
00,573200,552500,585504,608303,584930,549800,542200,609700,545842,609033,568800,521152,610240,585130,579900,5
27124,569600,513631,514000,535242,585400,527401,514101,531731,551111,554010,603920,611001,587830,586503,54260
0,587010,581841,535212,538301,501700,533502,585306,574500,561902,581843,577900,564021,569201,524530,501810,57
8902,536831,559500,504700,559220,609911,532602,551400,608100,600812,555000,532700,553200,584500,523404,585315
,538742,523105,534902,520202,565601,566000,547300,584701,518901,539800,586304,604410,553102,583900,506001,523
912,537601,598700,600320,542901,573525,541348,536653,598600,531003,538863,545201,527912,600100,566620,542906,
550500,505300,558300,534604,574702,524604,534200,585700,584410,549100,507900,541312,600831,545722,554800,5947
00,541320,504600,544600,502600,590300,584303,581602,601200,591900,597200,545500
keep if inlist(AUcode, `arealist')
// clears out remaining meshblock data that has areacodes missing a leading zero so get mixed up with area
units
drop if strpos(area_code_and_description, "MB")!=0

// apply formatting to make data more readable
drop area_code_and_description description
destring bach_2006 postg_2006 masters_2006 doct_2006 total_2006 bach_2013 ///
postg_2013 masters_2013 doct_2013 total_2013, replace

// create portion variable
gen bached_2006 = (bach_2006 + postg_2006 + masters_2006 + doct_2006) / total_2006
gen bached_2013 = (bach_2013 + postg_2013 + masters_2013 + doct_2013) / total_2013
label var bached_2006 "Bachelors degree+, 2006"
label var bached_2013 "Bachelors degree+, 2013"

drop bach_2006 postg_2006 masters_2006 doct_2006 total_2006 bach_2013 ///
postg_2013 masters_2013 doct_2013 total_2013

// convert to panel shape
reshape long bached_, i(AUcode) j(year)

// create duplicates for timeseries components
expand 26 if year == 2013
sort AUcode year
expand 11 if year == 2006
sort AUcode year

// generate month dates
gen date = .

local datelist
41000,41030,41061,41091,41122,41153,41183,41214,41244,41275,41306,41334,41365,41395,41426,41456,41487,41518,4
1548,41579,41609,41640,41671,41699,41730,41760,41791,41821,41852,41883,41913,41944,41974,42005,42036,42064,
42095
matrix input DATELIST = (`datelist')
local ColDATELIST = colsof(DATELIST)

forval k = 1/`ColDATELIST' {
    foreach i of num `k'(37)5032 {
        replace date = DATELIST[1,`k'] in `i'
    }
}

gen statadate = date + td(30dec1899)
format statadate %td

drop date
rename statadate date

gen month = mofd(date)
drop date
format month %tm

// set panel dataset
xtset AUcode month

// final touches
rename year censusdatayr
sort AUcode month
label var month Month
label var bached_ "Bachelors Education"
rename bached_ bached

```

```

format bached %9.2g
label var censusdatayr "Census Dataset"

// save dataset
save "$direct\Education.dta", replace

/*****
*****/
// stats NZ dwelling dataset
// creates portion variable for households using electricity for heating
clear
import delimited "$direct\Raw Datasets\2013-mb-dataset-Total-New-Zealand-Dwelling.csv"

set more off

// remove footnotes
keep in 1/49011

// drop all variables apart from 2006 and 2013 heating variable in question and the area identifiers
keep area_code_and_description code description v108 v116 v119 v127

// rename variables
rename v108 elecheat_2006
rename v119 elecheat_2013
rename v116 totdwell_2006
rename v127 totdwell_2013
rename code AUcode
label var AUcode "Area Unit Code"

// create list of area unit data we want to keep based on the NSP to Area Unit Mapping
local arealist
600323,508701,587100,597820,597713,584933,607400,580449,521160,600410,560301,501815,555400,593900,527133,6086
00,573200,552500,585504,608303,584930,549800,542200,609700,545842,609033,568800,521152,610240,585130,579900,5
27124,569600,513631,514000,535242,585400,527401,514101,531731,551111,554010,603920,611001,587830,586503,54260
0,587010,581841,535212,538301,501700,533502,585306,574500,561902,581843,577900,564021,569201,524530,501810,57
8902,536831,559500,504700,559220,609911,532602,551400,608100,600812,555000,532700,553200,584500,523404,585315
,538742,523105,534902,520202,565601,566000,547300,584701,518901,539800,586304,604410,553102,583900,506001,523
912,537601,598700,600320,542901,573525,541348,536653,598600,531003,538863,545201,527912,600100,566620,542906,
550500,505300,558300,534604,574702,524604,534200,585700,584410,549100,507900,541312,600831,545722,554800,5947
00,541320,504600,544600,502600,590300,584303,581602,601200,591900,597200,545500
keep if inlist(AUcode, `arealist')
// clears out remaining meshblock data that has areacodes missing a leading zero so get mixed up with area
units
drop if strpos(area_code_and_description, "MB")!=0

// apply formatting to make data more readable
drop area_code_and_description description
destring elecheat_2006 elecheat_2013 totdwell_2006 totdwell_2013, replace

// create portion variable
gen porteh_2006 = (elecheat_2006) / totdwell_2006
gen porteh_2013 = (elecheat_2013) / totdwell_2013
label var porteh_2006 "Portion using electric heating, 2006"
label var porteh_2013 "Portion using electric heating, 2013"

drop elecheat_2006 elecheat_2013 totdwell_2006 totdwell_2013

// convert to panel shape
reshape long porteh_, i(AUcode) j(year)

// create duplicates for timeseries components
expand 26 if year == 2013
sort AUcode year
expand 11 if year == 2006
sort AUcode year

// generate month dates
gen date = .

local datelist
41000,41030,41061,41091,41122,41153,41183,41214,41244,41275,41306,41334,41365,41395,41426,41456,41487,41518,4
1548,41579,41609,41640,41671,41699,41730,41760,41791,41821,41852,41883,41913,41944,41974,42005,42036,42064,
42095
matrix input DATELIST = (`datelist')
local ColDATELIST = colsof(DATELIST)

forval k = 1/`ColDATELIST' {
    foreach i of num `k'(37)5032 {
        replace date = DATELIST[1,`k'] in `i'
    }
}

```

```

}

gen statadate = date + td(30dec1899)
format statadate %td

drop date
rename statadate date

gen month = mofd(date)
drop date
format month %tm

// set panel dataset
xtset AUcode month

// final touches
rename year censusdatayr
sort AUcode month
label var month Month
label var porteh_ "Electric Heating"
rename porteh_ porteh
format porteh %9.2g
label var censusdatayr "Census Dataset"

// save dataset
save "$direct\Heating.dta", replace

/*****
*****/
// Stats NZ income dataset

clear
import delimited "$direct\Raw Datasets\2013-mb-dataset-Total-New-Zealand-Household.csv"

set more off

// remove footnotes
keep in 1/49011

// drop all variables apart from 2006 and 2013 income and the area identifiers
keep area_code_and_description code description v80 v90 v71 v72 v75 v76 v77 v81 v82 v85 v86 v87

/*****
/*                               RENAME VARIABLES AND ADD LABELS                               */
*****/
// median incomes
rename v80 MedInc2006
label var MedInc2006 "Median Income: 2006"
rename v90 MedInc2013
label var MedInc2013 "Median Income: 2013"

// households with income in bracket and total households 2006
rename v71 Hinc20_2006
label var Hinc20_2006 "Household Income $20,000 or less: 2006"
rename v72 Hinc30_2006
label var Hinc30_2006 "Household Income $20,001 to $30,000: 2006"
rename v75 Hinc70_2006
label var Hinc70_2006 "Household Income $70,001 to $100,000: 2006"
rename v76 Hinc100_2006
label var Hinc100_2006 "Household Income $100,000+: 2006"
rename v77 TotH_2006
label var TotH_2006 "Total households stated: 2006"

// households with income in bracket and total households 2013
rename v81 Hinc20_2013
label var Hinc20_2013 "Household Income $20,000 or less: 2013"
rename v82 Hinc30_2013
label var Hinc30_2013 "Household Income $20,001 to $30,000: 2013"
rename v85 Hinc70_2013
label var Hinc70_2013 "Household Income $70,001 to $100,000: 2013"
rename v86 Hinc100_2013
label var Hinc100_2013 "Household Income $100,000+: 2013"
rename v87 TotH_2013
label var TotH_2013 "Total households stated: 2013"
/*****

// create list of area unit data we want to keep based on the NSP to Area Unit Mapping
local arealist
600323,508701,587100,597820,597713,584933,607400,580449,521160,600410,560301,501815,555400,593900,527133,6086
00,573200,552500,585504,608303,584930,549800,542200,609700,545842,609033,568800,521152,610240,585130,579900,5
27124,569600,513631,514000,535242,585400,527401,514101,531731,551111,554010,603920,611001,587830,586503,54260

```

```

0,587010,581841,535212,538301,501700,533502,585306,574500,561902,581843,577900,564021,569201,524530,501810,57
8902,536831,559500,504700,559220,609911,532602,551400,608100,600812,555000,532700,553200,584500,523404,585315
,538742,523105,534902,520202,565601,566000,547300,584701,518901,539800,586304,604410,553102,583900,506001,523
912,537601,598700,600320,542901,573525,541348,536653,598600,531003,538863,545201,527912,600100,566620,542906,
550500,505300,558300,534604,574702,524604,534200,585700,584410,549100,507900,541312,600831,545722,554800,5947
00,541320,504600,544600,502600,590300,584303,581602,601200,591900,597200,545500
keep if inlist(code, `arealist')
// clears out remaining meshblock data that has areacodes missing a leading zero so get mixed up with area
units
drop if strpos(area_code_and_description, "MB")!=0

// should now have income data for 136 area units

// apply formatting to make data more readable
format %50s area_code_and_description
drop description
destring Hinc20_2006 Hinc30_2006 Hinc70_2006 Hinc100_2006 ///
TotH_2006 MedInc2006 Hinc20_2013 Hinc30_2013 Hinc70_2013 ///
Hinc100_2013 TotH_2013 MedInc2013, replace

// calculate income portion variables
// Portion with household income < 30k
gen phinc30_2006 = (Hinc20_2006 + Hinc30_2006)/TotH_2006
gen phinc30_2013 = (Hinc20_2013 + Hinc30_2013)/TotH_2013
label var phinc30_2006 "Portion with household income less than $30k"
label var phinc30_2013 "Portion with household income less than $30k"

// Portion with household income > 70k
gen phinc70_2006 = (Hinc70_2006 + Hinc100_2006)/TotH_2006
gen phinc70_2013 = (Hinc70_2013 + Hinc100_2013)/TotH_2013
label var phinc70_2006 "Portion with household income greater than $70k"
label var phinc70_2013 "Portion with household income greater than $70k"

// Portion with household income > 100k
gen phinc100_2006 = (Hinc100_2006)/TotH_2006
gen phinc100_2013 = (Hinc100_2013)/TotH_2013
label var phinc100_2006 "Portion with household income greater than $100k"
label var phinc100_2013 "Portion with household income greater than $100k"

// clear unnecessary variables
drop Hinc20_2006 Hinc30_2006 Hinc70_2006 Hinc100_2006 ///
TotH_2006 Hinc20_2013 Hinc30_2013 Hinc70_2013 Hinc100_2013 TotH_2013

// convert to panel shape
reshape long MedInc phinc30_ phinc70_ phinc100_, i(code) j(year)
rename MedInc medinc
rename phinc30_ phinc30
rename phinc70_ phinc70
rename phinc100_ phinc100
rename code AUcode
drop area_code_and_description
sort AUcode year

// 2013 census date was 5 March 2013
// apply 2013 data from March 2013 onwards (26 months), 2006 data otherwise (11 months)

// create duplicates for timeseries components
expand 26 if year == 2013
sort AUcode year
expand 11 if year == 2006
sort AUcode year

// generate month dates
gen date = .

// dates from April 2012 to April 2015
local datelist
41000,41030,41061,41091,41122,41153,41183,41214,41244,41275,41306,41334,41365,41395,41426,41456,41487,41518,4
1548,41579,41609,41640,41671,41699,41730,41760,41791,41821,41852,41883,41913,41944,41974,42005,42036,42064,
42095
matrix input DATELIST = (`datelist')
local ColDATELIST = colsof(DATELIST)

forval k = 1/`ColDATELIST' {
    foreach i of num `k'(37)5032 {
        replace date = DATELIST[1,`k'] in `i'
    }
}

gen statadate = date + td(30dec1899)

```

```

format statadate %td

drop date
rename statadate date

gen month = mofd(date)
drop date
format month %tm

// set panel dataset
xtset AUcode month

// final touches
rename year censusdatayr
sort AUcode month
label var month Month
label var medinc "Median Household Income"
label var phinc30 "Household Income (under $30k)"
label var phinc70 "Household Income ($70k+)"
label var phinc100 "Household Income ($100k+)"
label var censusdatayr "Census Dataset"
label var AUcode "Area Unit Code"
format phinc30 phinc70 phinc100 %9.2g

// save dataset
save "$direct\MedianIncome.dta", replace

/*****
*****/
// join Stats NZ datasets
clear

use "$direct\Age.dta"
merge m:m AUcode month using "$direct\MedianIncome.dta"
drop _merge
save "$direct\CombinedStatsNZ.dta", replace

use "$direct\CombinedStatsNZ.dta"
merge m:m AUcode month using "$direct\Education.dta"
drop _merge
save "$direct\CombinedStatsNZ.dta", replace

use "$direct\CombinedStatsNZ.dta"
merge m:m AUcode month using "$direct\Heating.dta"
drop _merge
save "$direct\CombinedStatsNZ.dta", replace

format medage portpop60 portpop2030 medinc phinc30 phinc70 phinc100 bached porteh %9.2g
save "$direct\CombinedStatsNZ.dta", replace

/*****
*****/
// create master file

clear
use "$direct\Switching.dta"
merge m:1 rootnsp using "$direct\NSPDesc.dta"
drop _merge
format switchrate %9.2g
gen rootnspshort = substr(rootnsp, 1, 7)
label var rootnspshort "Root NSP Short"

save "$direct\Master.dta", replace

// merge master with Stats NZ data
clear
use "$direct\Master.dta"
merge m:m AUcode month using "$direct\CombinedStatsNZ.dta"
drop if missing(rootnsp)
drop _merge
save "$direct\Master.dta", replace

/*****
*****/
// pricing and savings dataset
clear
use "$direct\AllPriceData_Base.dta", clear

// EA calculates savings based on assumption that all consumers switched to
// the cheapest retailer in their region. We calculate our savings proxy in a
// similar manner, with the savings as the difference between the average price

```

```

// and that offered by the cheapest retailer

drop date areaid regionid newid
order region area month retailer id price
sort region area month retailer
xtset id month

// generate retailer price shock variables
gen pricelag = L.price
gen shock = (price - pricelag)/pricelag*100
format shock %9.2g
label var shock "Change in average price (%)"
drop pricelag
gen pshock5 = 0
replace pshock5 = 1 if shock >= 5 & shock != .
gen pshock3 = 0
replace pshock3 = 1 if shock >= 3 & shock != .

// collapse dataset to create savings variables
collapse (max) maxprice = price (min) minprice = price (mean) avgprice = price (max) pshock5 pshock3,
by(region area month)
gen savings = avgprice - minprice
label var savings "Average Saving ($)"
label var pshock5 "Price Shock (> 5%)"
label var pshock3 "Price Shock (> 3%)"
format savings %9.2g

// encode area to be used in merging process
encode area, gen(areaid)
gen pmid = areaid
label var pmid "Price Mapping ID"
drop areaid
order region area month maxprice minprice avgprice savings pmid
sort region area month

xtset pmid month

// potential extension is to create WA saving but this requires matching all
// prices to market share data

// save dataset
save "$direct\Savings.dta", replace

/*****
*****/
// merge master with savings data
clear
use "$direct\Master.dta"
merge m:m pmid month using "$direct\Savings.dta"
drop area region _merge
drop if missing(rootnsp)
label var maxprice "Max. retail price"
label var avgprice "Avg. retail price"
label var minprice "Min. retail price"
gen savingspc = savings/ avgprice * 100
label var savingspc "Average Savings (%)"

save "$direct\Master.dta", replace

/*****
*****/
// market share dataset
clear
import delimited "$direct\Raw Datasets\20150616_Market_share_trends_by_root_NSP.csv"

set more off

// rename variables
rename v1 date
rename v2 rootnsp
rename v3 retailercode
rename v4 retailer
rename v5 icp
rename v6 ms

label var ms "Market Share"
label var rootnsp "Root NSP"
label var retailercode "Retailer ID"
label var retailer "Retailer"
label var icp "Connected ICPs"

```

```

// remove header that is not sorted to the top in the file
drop if rootnsp == "Region"

// create month variable
gen d=date(date, "YMD", 2010)
format d %td

gen month = mofd(d)
drop d
drop date
format month %tm
label var month Month

// save dataset
save "$direct\MarketShare.dta", replace

// remove old brand names
// BOP Energy and Todd Energy are recast as Nova Energy
// We cannot simply rename the retailer and retailer code as we will have duplicate observations in our panel
// We collapse these fields and then reappend the aggregated observation per nsp month
collapse (sum) icp ms if retailer == "Nova Energy" | retailer == "BOP Energy" | retailer == "Todd Energy",
by(rootnsp month)
gen retailer = "Nova Energy"
gen retailercode = "AGCL"
label var retailercode "Retailer ID"
label var retailer "Retailer"
label var ms "Market Share"
label var icp "Connected ICPs"

// save dataset
save "$direct\MarketShare_NOVA.dta", replace

// append NOVA dataset back to original
use "$direct\MarketShare.dta"
drop if retailer == "Nova Energy" | retailer == "BOP Energy" | retailer == "Todd Energy"
append using "$direct\MarketShare_NOVA.dta"
sort rootnsp month retailer

// save dataset
save "$direct\MarketShare.dta", replace

// specify observation period to match price data
drop if month < ym(2012, 4)
drop if month > ym(2015, 4)

egen id = group(rootnsp retailer)
sort id month

// set panel structure
xtset id month

// generate market statistics by nsp month
// get max. retailer market share by nsp month (to check for dominant firm) and the # of retailers
encode retailercode, gen(retcodeid)
collapse (max) ms (count) retcodeid, by(rootnsp month)
sort month rootnsp

rename ms maxms
rename retcodeid retailercount

label var maxms "Market share of largest retailer"
label var retailercount "Number of retailers"

// generate dominance dummy variables
gen dom50 = 0
replace dom50 = 1 if maxms >= 50
label var dom50 "Dominant firm (50%+)"

gen dom60 = 0
replace dom60 = 1 if maxms >= 60
label var dom60 "Dominant firm (60%+)"

gen dom70 = 0
replace dom70 = 1 if maxms >= 70
label var dom70 "Dominant firm (70%+)"

// save dataset
save "$direct\MarketShare.dta", replace

/*****
*****/

```



```

// merge master with market share data
clear
use "$direct\Master.dta"
merge m:m rootnsp month using "$direct\MarketShare.dta"
drop if missing(island)
drop _merge
drop if missing(avgicp)

save "$direct\Master.dta", replace

// merge master with demand data
clear
use "$direct\Master.dta"
merge m:m rootnspshort month using "$direct\Demand.dta"
drop if missing(rootnsp)
drop _merge rootnspshort
save "$direct\Master.dta", replace

/*****
*****/
// create additional month dummy variables and avg demand
gen avgdem = demand / avgicp
label var avgdem "Average ICP Demand"
gen date = dofm(month)
format date %td
gen monthname = month(date)
gen winter = 0
replace winter = 1 if monthname == 6 | monthname == 7 | monthname == 8
label var winter "Winter"
gen shol = 0
replace shol = 1 if monthname == 12 | monthname == 1
label var shol "Holiday"
drop monthname date

// create dummy variables for known Whats my Number advertising campaigns
gen wmn2 = 0
replace wmn2 = 1 if tin(2012m2, 2012m11)
gen wmn3 = 0
replace wmn3 = 1 if tin(2013m4, 2013m9)
label var wmn2 "WmN Campaign 2012"
label var wmn3 "WmN Campaign 2013"

save "$direct\Master.dta", replace

/*****
*****/
// analysis
clear
use "$direct\Master.dta"

cd "$direct\Output"

sort nspid month
set more off

// base specification
global xlist savingspc pshock5 portpop60 phinc100 bached porteh dom50 avgdem ///
winter shol wmn2 wmn3

global xlistlag savingspc pshock5 portpop60 phinc100 bached porteh dom50 avgdem ///
winter shol wmn2 wmn3 l(1/2).wmn2 l(1/2).wmn3

global ylist switchrate

// alternative specification
global xlist2 savingspc pshock5 portpop20-29 phinc30 bached porteh dom50 ///
avgdem winter shol wmn2 wmn3

// full specification
global xlist3 savingspc pshock5 portpop20-29 portpop60 phinc30 phinc100 bached ///
porteh dom50 avgdem winter shol wmn2 wmn3

// data is unbalanced panel with 139 individuals (nsp) and 37 time periods
// unbalanced panel due to time gaps (average time observations 33.9)
xtsum
xtdes

by nspid: egen times=count(month)
xttab times
drop times
est clear

```

```

/*****
/*                                POLS VS FIXED EFFECTS
*/
*****/

// pooled OLS estimator
reg $ylist $xlist, vce(cluster nspid)
eststo, title("POLS")
scalar R2POLS = e(r2)

// LSDV
reg $ylist $xlist i.nspid, vce(cluster nspid)
scalar R2LSDV= e(r2)

// run F-test of restrictions to compare LSDV and POLS
scalar F = ((R2LSDV - R2POLS)/(169-1))/((1-R2LSDV)/(5568 - 169 - 12))
di F

// store WG results which are identical to avoid presenting all the individual DV
areg $ylist $xlist, absorb(nspid) vce(cluster nspid)
eststo, title("LSDV")

// pooled OLS estimator on lag campaign model
reg $ylist $xlistlag, vce(cluster nspid)
eststo, title("POLS ")

// store WG results which are identical to avoid presenting all the individual DV
areg $ylist $xlistlag, absorb(nspid) vce(cluster nspid)
eststo, title("LSDV ")

// create table to show output
esttab, se r2 ar2 label b(5) se(5) star(* 0.10 ** 0.05 *** 0.01) title(Table 1)
esttab using Table1.rtf, mtitles se r2 ar2 label b(5) se(5) star(* 0.10 ** 0.05 *** 0.01) ///
replace title(Table 1)

/*****
/*                                RANDOM VS. FIXED EFFECTS
*/
*****/

est clear

// fixed effects specification
xtreg $ylist $xlist, fe
estimates store fixed
eststo, title("FE")

// random effects estimator (RE)
xtreg $ylist $xlist, re theta
estimates store random
eststo, title("RE")

esttab, se label b(5) se(5) scalars(r2_o r2_b r2_w sigma_u sigma_e rho) ///
star(* 0.10 ** 0.05 *** 0.01) title(Table 2)
esttab using Table2.rtf, mtitles se label b(5) se(5) star(* 0.10 ** 0.05 *** 0.01) ///
replace title(Table 2) scalars(r2_o r2_b r2_w sigma_u sigma_e rho)

// run standard Hausman test, use sigmamore specification following Cameron & Trivedi (2010)
hausman fixed random, sigmamore

// standard Hausman requires the RE estimator to be efficient, which requires that
// the ai's and the eit are iid, which is invalid if cluster robust se's differ largely
// from the default se. thus we need to compute a bootstrapped version

// use xtoverid to compute bootstrapped Hausman test (user written)
// requires ivreg2 to be installed also
ssc install xtoverid
ssc install ivreg2

xtreg $ylist $xlist, re vce(cluster nspid)
xtoverid
di r(j)

// conclusion is still that RE is not appropriate

/*****
/*                                ALTERNATIVE SPECIFICATIONS
*/
*****/

est clear

```

```

// first difference model
// specify no constant to assume there is no time trend
reg d.$ylist d.$xlist, vce(cluster nspid) noconstant
eststo, title("First Diff.")

esttab, se r2 ar2 mtitles nonumbers nodepvars
esttab using Table3.rtf, mtitles se r2 ar2 label b(5) se(5) star(* 0.10 ** 0.05 *** 0.01) ///
replace title(Table 3)

/*****
/*
*/
TESTING TIME COMPONENTS
*/
*****/
est clear

// investigate dynamic nature between y and its lags
sort nspid month
correlate switchrate l(1/2).switchrate

// run full ar(k) model
reg $ylist l(1).$ylist, vce(cluster nspid) noconstant
eststo, title("AR(1)")

reg $ylist l(1/2).$ylist, vce(cluster nspid) noconstant
eststo, title("AR(2)")

reg $ylist l(1/4).$ylist, vce(cluster nspid) noconstant
eststo, title("AR(4)")

reg $ylist l(1/6).$ylist, vce(cluster nspid) noconstant
eststo, title("AR(6)")

reg $ylist l(1/12).$ylist, vce(cluster nspid) noconstant
eststo, title("AR(12)")
esttab, se r2 ar2 mtitles nonumbers nodepvars label star(* 0.1 ** 0.05 *** 0.01)
esttab using Table4.rtf, mtitles se r2 ar2 label b(5) se(5) star(* 0.10 ** 0.05 *** 0.01) ///
replace title(Table 4)

// appears to be pattern of every 3 months from switching period, perhaps indicating
// that consumers are reevaluating their options on such a basis

/*****
/*
*/
DYNAMIC MODEL SPECIFICATIONS
*/
*****/

est clear

// run simple AR(1)
reg $ylist l(1).$ylist, vce(cluster nspid)
eststo, title("AR(1) POLS")

// run pols with lagged dependent variable
reg $ylist l(1).$ylist $xlist, vce(cluster nspid)
eststo, title("AR(1) POLS")

// FE with AR component
areg $ylist l(1).$ylist $xlist, absorb(nspid) vce(cluster nspid)
eststo, title("AR(1) FE")

// AB estimator
// needs user written command xtabond2
ssc install xtabond2
xtabond2 $ylist l(1).$ylist $xlist, gmm(L.$ylist) iv($xlist) nolevel robust
eststo, title("A-B")

xtabond2 $ylist l(1).$ylist $xlist, gmm(L.$ylist) iv($xlist) nolevel robust orthogonal
eststo, title("A-B Orthogonal")

esttab, se r2 ar2 mtitles nonumbers nodepvars label star(* 0.1 ** 0.05 *** 0.01)
esttab using Table5.rtf, mtitles se r2 ar2 label b(5) se(5) star(* 0.10 ** 0.05 *** 0.01) ///
replace title(Table 5)

/*****
// repeated with additional lags considered
est clear
ssc install xtabond2
xtabond2 $ylist l(1).$ylist $xlist, gmm(L.$ylist) iv($xlist) nolevel robust
eststo, title("AB FD")

xtabond2 $ylist l(1).$ylist $xlist, gmm(L.$ylist) iv($xlist) nolevel robust orthogonal
eststo, title("AB FOD")

```

```

xtabond2 $ylist l(1,12).$ylist $xlist, gmm(L.$ylist) iv($xlist) nolevel robust
eststo, title("AB FD")

xtabond2 $ylist l(1,12).$ylist $xlist, gmm(L.$ylist) iv($xlist) nolevel robust orthogonal
eststo, title("AB FOD")

xtabond2 $ylist l(1,3,6,9,12).$ylist $xlist, gmm(L.$ylist) iv($xlist) nolevel robust
eststo, title("AB FD")

xtabond2 $ylist l(1,3,6,9,12).$ylist $xlist, gmm(L.$ylist) iv($xlist) nolevel robust orthogonal
eststo, title("AB FOD")

esttab, se mtitles nonumbers nodepvars label star(* 0.1 ** 0.05 *** 0.01)
esttab using Table6.rtf, mtitles se label b(5) se(5) star(* 0.10 ** 0.05 *** 0.01) ///
replace title(Table 6)

```